



SCIENCE SHEETG 4

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Concept 1

lesson (1)

Adaptation.

The living organisms protect itself from the extreme heat by

Desert lizard : by finding shaded area

Human : by using umbrella

Palm leaves : covered by waxy layer

The adaptation :

It is a characteristics that help living organisms to change to survive and reproduce

Adaptation of penguins to survive in cold environment:

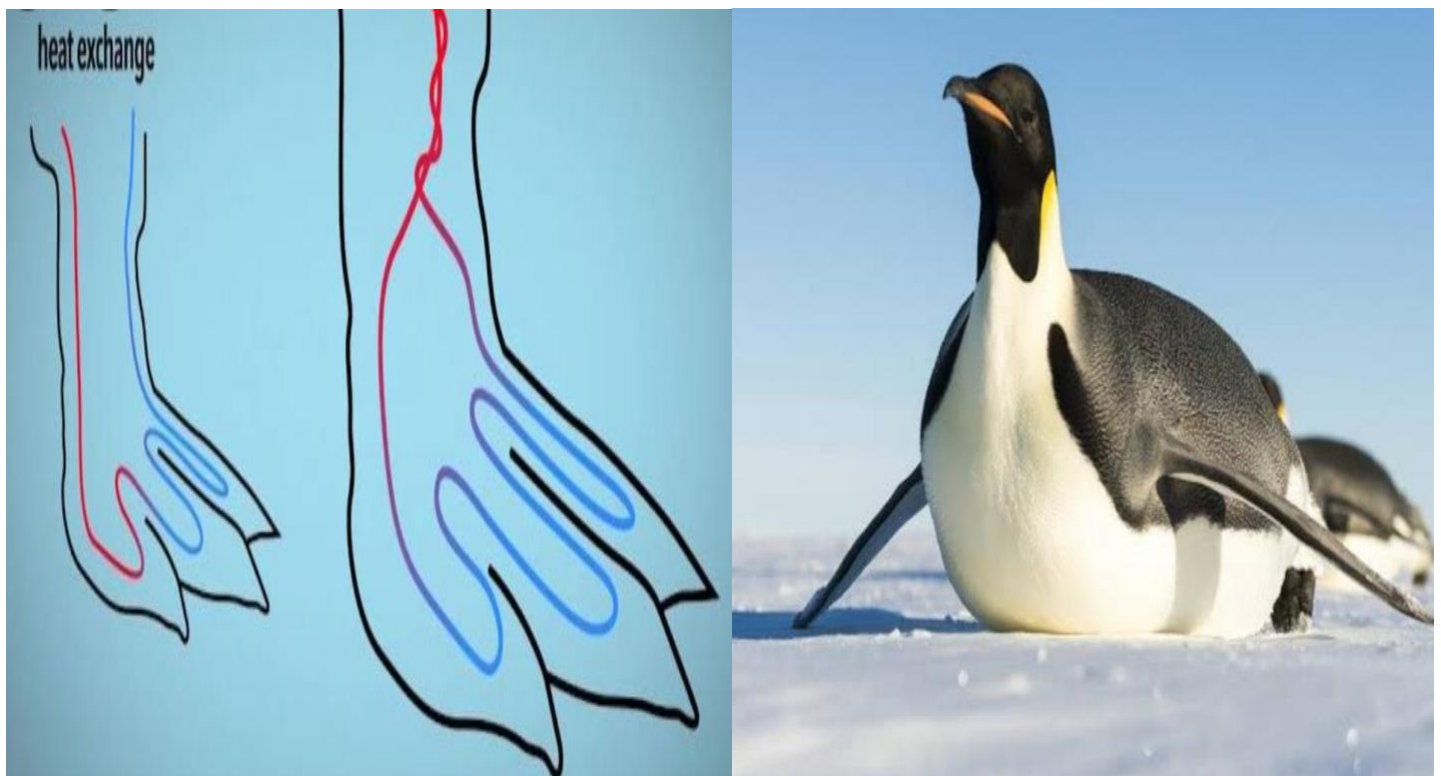
Penguins live in :

Antarctica — Polar region — Polar climate.

Penguin adaptation: has fat layer and thick feather on his body To keep its body **warm** in the freezing cold.

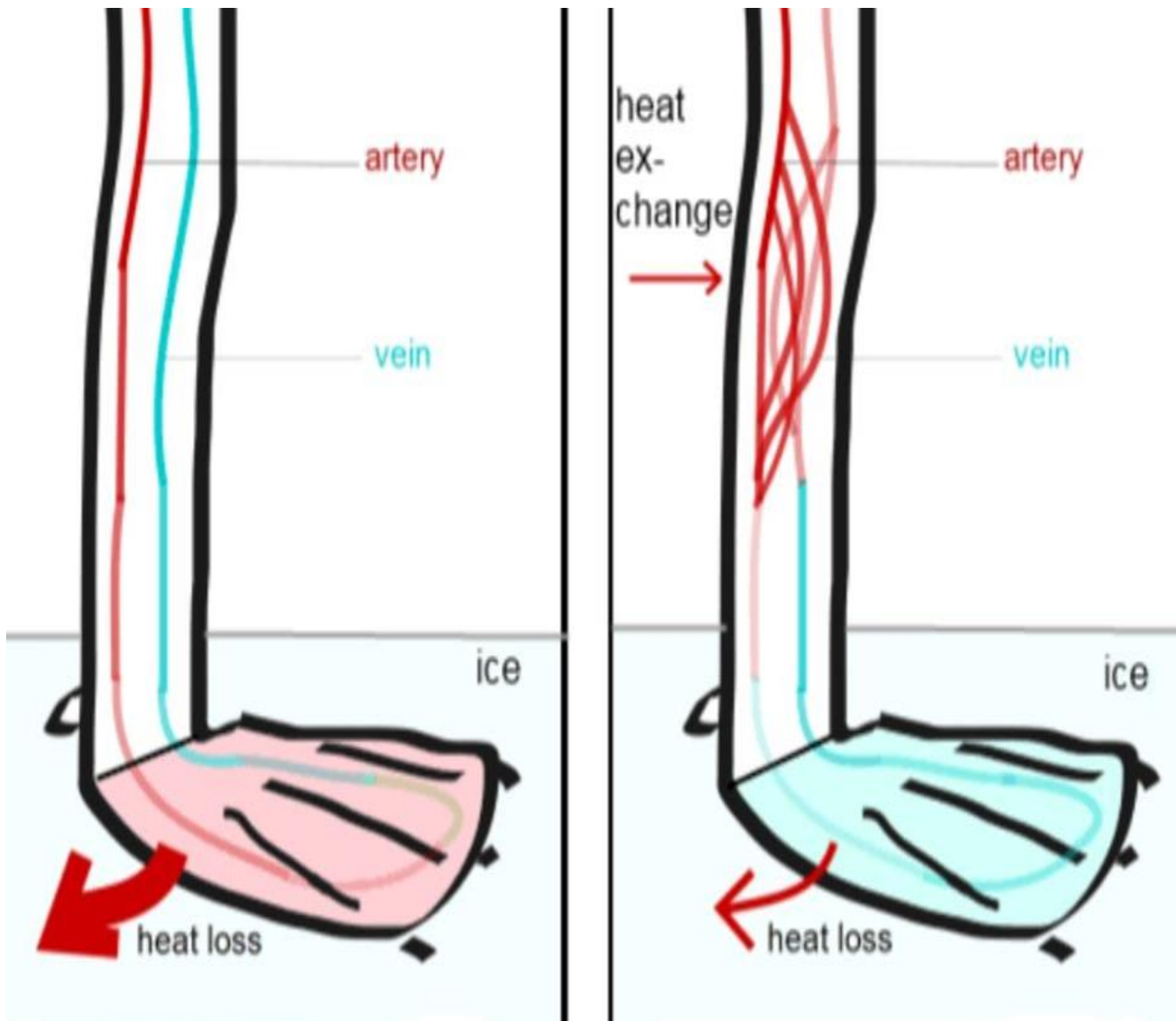
Penguin toes feet have no fat, no feather

How penguin keeps its toes feet from freezing?



The warm blood vessels from body weave around the cold blood vessels from feet to heat up.

Note: warm blood from body move down — cold blood from feet move up.



Camouflage: It is an example of adaptation in which some animals hide from predators or preys by blending with surrounding environment.

Examples :

1- Polar bear:

Polar bear live in **arctic region**

Polar bear adaptation: It has white fur

To help it blends with snow to sneak up on its prey.

- Polar bear has thick fur To keep it warm in cold arctic.



2- Brown bear and dark bear:

Habitat : They live in forests

Adaptation: They have dark fur

To stay hidden between trees as they hunt.



3-Caracal and fennec fox:

Habitat : They live in desert.

Caracal and fennec fox **adaptation**: They have sandy (tan) colored fur To **hide** and blend with desert environment.






3-Lizards: It lives in desert between colorful rocks.

Lizards adaptation: They have colorful scales

To make them hard to see between rocks.



Lesson (2) Types of Adaptations

<u>Structural</u>	<u>Behavioural</u>
<i>Change in the structure of its body</i>	<i>Change in the behaviour of living organisms</i>
<i>Ex) fennec fox has sandy fur</i> <i>Ex) bolar bear has white fur</i>	<i>ex)lizard looks for shade in the sunny days</i> <i>ex) birds migration at certain time of year</i>
	 

Arctic fox

Live in tundra desert



Structural adaptation :

It has thick fur coat To keep body warm in cold climate

It has white fur coat in winter and brown in summer

To sneak up on prey in any season

It has short ears and legs To help it stays warm

It has a special shape of ears To allow good hearing for hunts

Fennec fox

Live in hot dessert



Structural adaptation :

It has tan colored coat To hide in sandy environment To protect from the hot sun

It has extra-large ears To lose heat to cool its body

It has a special shape of ears To allow good hearing for hunts

Behavioral adaptation :

It lives in burrows To stay warm at night



Behavioral adaptation:

***It pants like dogs and reach to 700 breath per minute To cool its body
It lives in burrows To stay cool in sunny days***



It eats different kinds of food like :

***Feed on all types of insects , fruits and food leftover from other predators
Bec. hard to find food in desert***

It eats different kinds of food like :

***Feed on all types of insects , fruits and food leftover from other predators
Bec. hard to find food in desert***

Bull shark :

Unique advantage It lives in fresh and salty water

Structural adaptation : *It has dark back and white belly To sneak up on prey by **countershading** strategy*

It has sharp teeth To tear prey's flesh

Behavioral adaptation :

It can hunt in salty and fresh water So, It feeds on different types of food It hunts in the day and the night So, Its prey can't predict hunt time

Note: Bull shark faces less competition for finding food as no sharks live in fresh water.



Panther chameleon (lizard)

Habitat : It lives in tropical rainforest

Structural adaptation :

It has bright colored scales To camouflage with surrounding environment



Its eyes move in opposite directions One eye search food and The other eye **to** avoid danger



It has very long sticky tongue **To** hunt insects for feeding

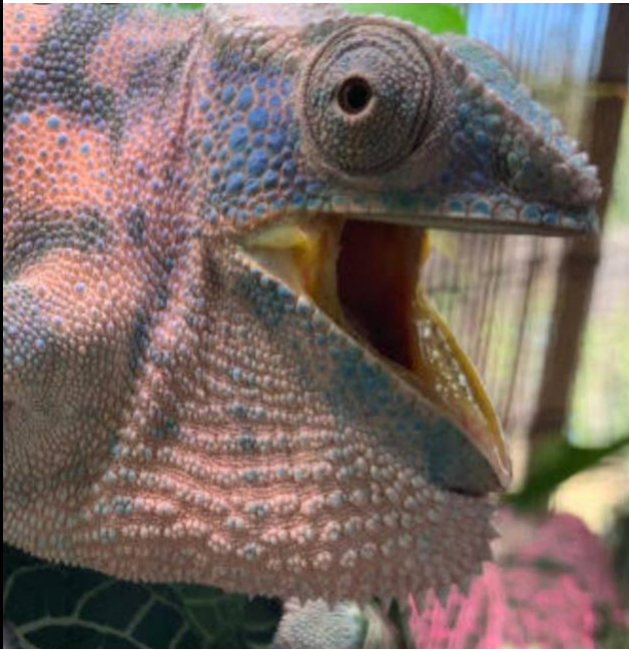


*It has V-shaped feet and tail like a hand **To** hold tightly the branches of tree*



Behavioral adaptation :

In danger it scare its attacker by: It puffs up its body with air. It opens its mouth wide. It changes scales color.



Lesson (3). Plant Adaptation

Characteristics of savannah forest in Southern Africa :

- Savannah forest is a grassland habitat.**
- The temperature in the savannah forest is mild.**
- In the savannah, there is extreme lack of water during the dry season which lasts for half of the year without rainfall.**

Savannah forest is characterized by drought conditions, so most of large plants can't grow.

Adaptation of the two terrific trees to survive in their environments



Acacia tree (umbrella-shaped tree)

- Its habitat :It grows in savannah forest in Southern Africa.
- **Its structural adaptation :**

Root : It has a very long root grows directly Downward known as the "taproot".

It searches for water as deep as 35 meters below the soil surface.

Trunk : Its trunk is very long, so most animals except giraffe cannot reach its Leaves to feed on.

Acacia tree stores water in its trunk

Leaves : It has tiny leaves growing on its top to help it Hold in water, while soaking up sunlight needed to Make food. Its leaves have sharp spines to protect them from Hungry mouths of animals.

- **Its behavioral adaptation :**

Acacia tree can defend itself

When an animal begins eating the leaves of the acacia tree also begins to produce a poison that makes the leaves taste very bad. Then it sends a smelly message in the wind to acacia trees nearby telling them to start making the same poison.



Characteristics of Amazon rainforest of Brazil :

In the rainforest, it is easy to find water, where it is rainy most of the year.

- It is hard for plants in the rainforest to reach sunlight.**
- The rainforest has a soggy soil which means that it is a wet muddy soil.**
- The rainforest is characterized by strong winds.**
- The trees in the rainforest grow up to 70 meters tall,**



Kapok tree

- **Its habitat** : It grows in the Amazon rainforest of Brazil.
- **Its structural adaptation** :

Root : Buttress roots

The kapok tree stays firmly rooted due to large, wide roots Buttress roots are not planted deeply in the ground but They grow high up on its trunk to hold the tree firmly in the

Soggy soil. : Some of these roots can start up to 5 meters above the Ground.







Leaves : It has hand-shaped leaves with narrow parts that allow wind To move more gently through the leaves without tearing them.



- **Its behavioral adaptation :**

The kapok tree uses the wind to send a different type of Messages than the acacia, where the kapok tree invites bats



Plant	Its habitat	Its structural adaptation	This adaptation helps the plant to survive because
 Mangrove tree	Salt water	It has long and strong roots.	The long and strong roots help the plant to resist the waves.
 Water lily	Wetland	It has wide leaves that float on the water surface.	The wide leaves help the plant to absorb a big amount of sunlight.
 Palm tree	Desert	<ul style="list-style-type: none"> - It has thick roots. - It has small leaves. 	Both thick roots and small leaves help the plant to resist the strong winds.
 Pine tree	Snow	<ul style="list-style-type: none"> - This tree has a triangular shape. - It has short branches. - It has needle leaves 	<ul style="list-style-type: none"> - The triangular shape of this tree and its short branches allow the snow to slide easily over it, so its branches don't break. - The needle leaves prevent the plant from losing of
 Acacia tree	Savannah	Its branches grow and gather on the top of its trunk.	The branches at the top of its trunk prevent the animals from reaching the leaves on the tip of these branches.
 Barbary fig	Desert	It has sharp spines.	The sharp spines prevent the animals from eating its leaves and fruits.

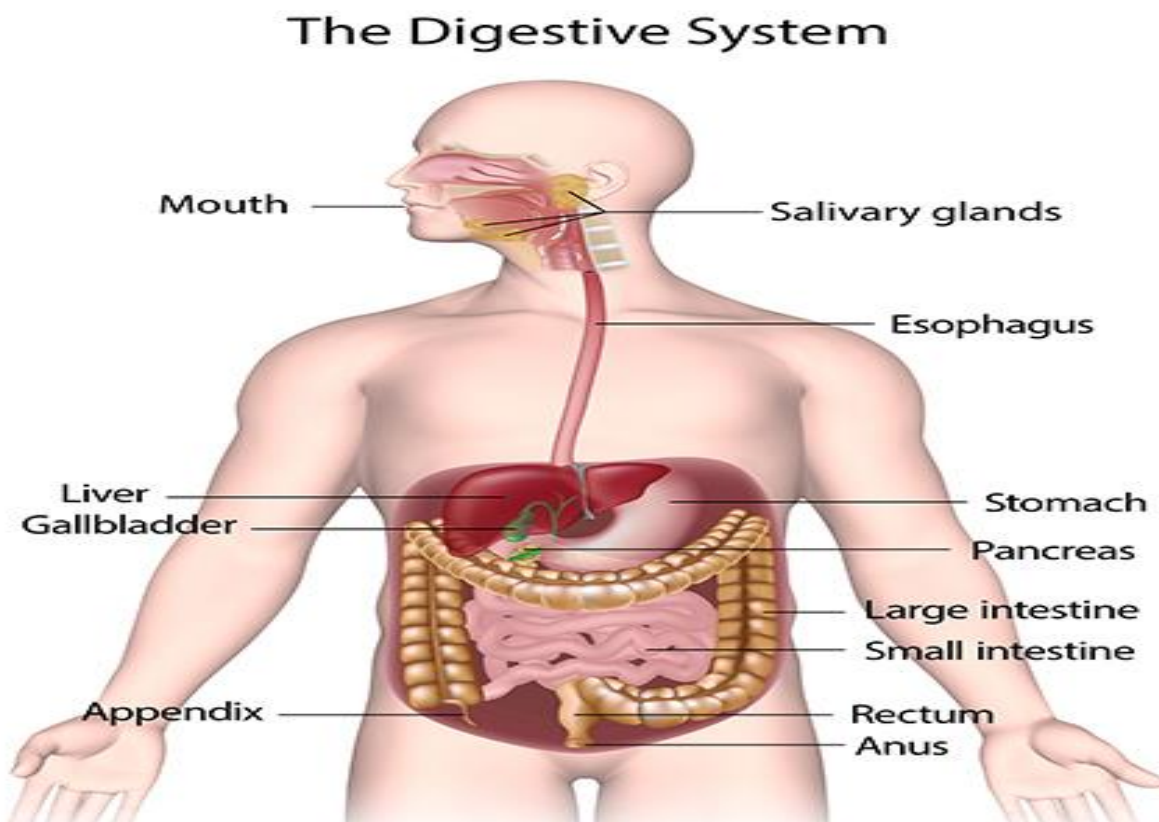
Lesson (4) .Human digestive system

- Digestive system :

It is the system responsible for breaking down food into small parts to enable the body cells to use them in energy.

- Digestion proces :

It is the process of breaking down food and changing it into chemical substances that the body absorbs and uses them in getting energy and growth.



The structure of the digestive system :

Digestion begins in the mouth.

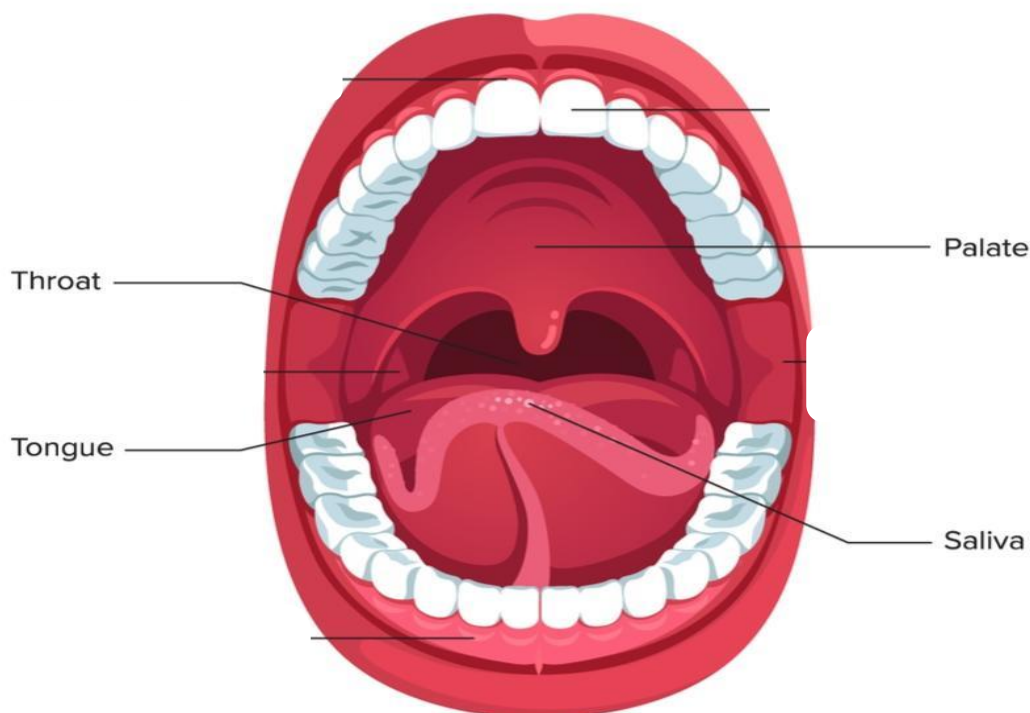
- **Mouth contains** : Teeth _ Saliva _ Tongue.

- Function of teeth : They break down and crush food in the mouth during chewing.

Function of saliva : It helps in the digestion of some types of food, (where it digests starch and changes it into sugar).

- It facilitates the swallowing of food.

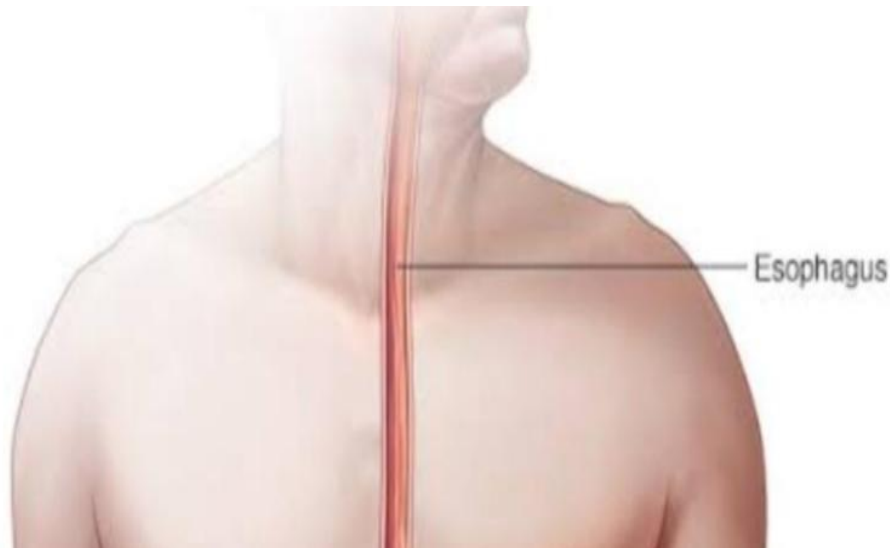
- Function of tongue : It mixes food with saliva in the mouth.



During swallowing the food, the throat (pharynx) pushes the food into esophagus.

- **Esophagus** is a long muscular tube.

Its function : It moves the food down into the stomach .



- **Stomach** It is a muscular organ.

Its function : The stomach mixes food with the stomach acid and digestive juices found in it to change the food into a soupy liquid. Food stays in the stomach for a few hours, then the muscles of the stomach move the food into small Intestine

- **Small intestine** It is a long, winding tube as its length is more than six meters

- Pancreas and liver secrete juices that flow into the small intestine.

- These juices help in breaking down the food into nutrients (or digested food).

- These nutrients are absorbed through the wall of the small intestine as they enter into tiny blood vessels and reach the blood.

- The blood carries the nutrients to all parts of the body.

- **Its function** : It completes the digestion of different types of food. It absorbs the nutrients

- **the large Intestine** : is a tube that starts from the end of the small Intestine and ends with the anus.

- **Its function** : It absorbs water from the undigested materials, so they become solid wastes that come out through the anus.

• How can you keep the digestive system healthy ?

1_ Chew the food well.

2_ Drink a lot amount of water.

3_ Don't eat much fast meals.

4_ Practice sports regularly.



general function of the digestive system :

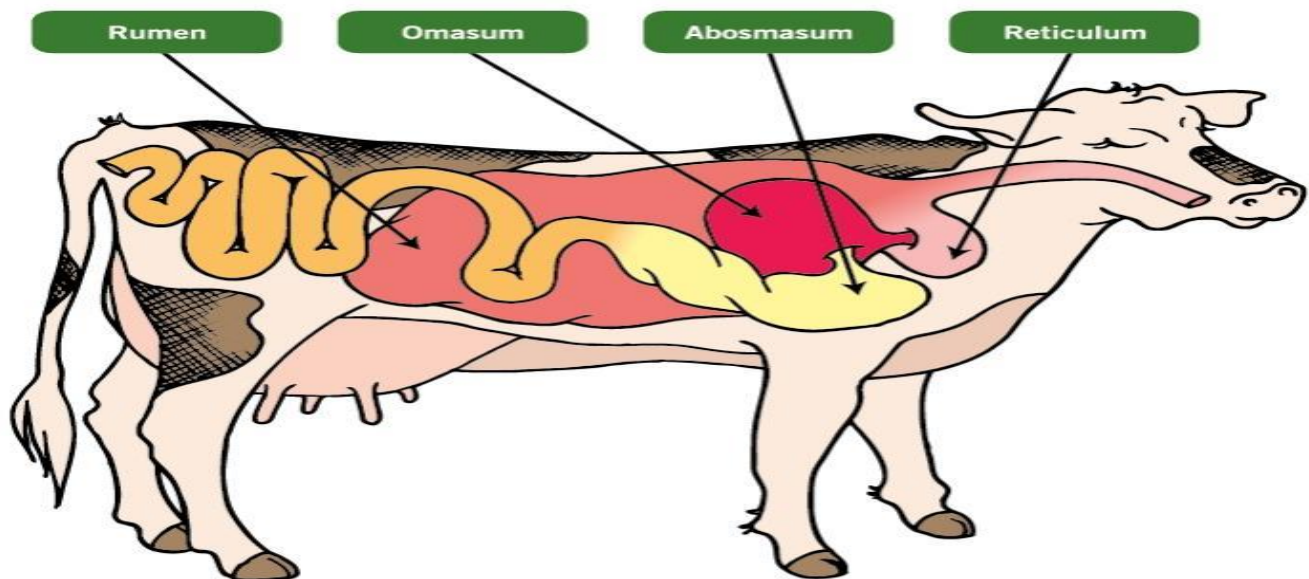
- Extracting nutrients from the food we eat.
- Digestion of food and its absorption to obtain the needed energy.

The digestive system of cow and dog consists of :

Mouth _Stomach _Esophagus _Intestines_Stomach

Adaptation of the digestive system of cow

- Cow eats grass.
- Grass is very difficult to be digested, so cow has a long digestive system and Cow is characterized by having four stomach-like organs (compartments



which are :

- **Rumen_Rettcutum_Omasum_Abosmasum**
- Cow has flat teeth that are suitable for eating grass.

happens if... ?

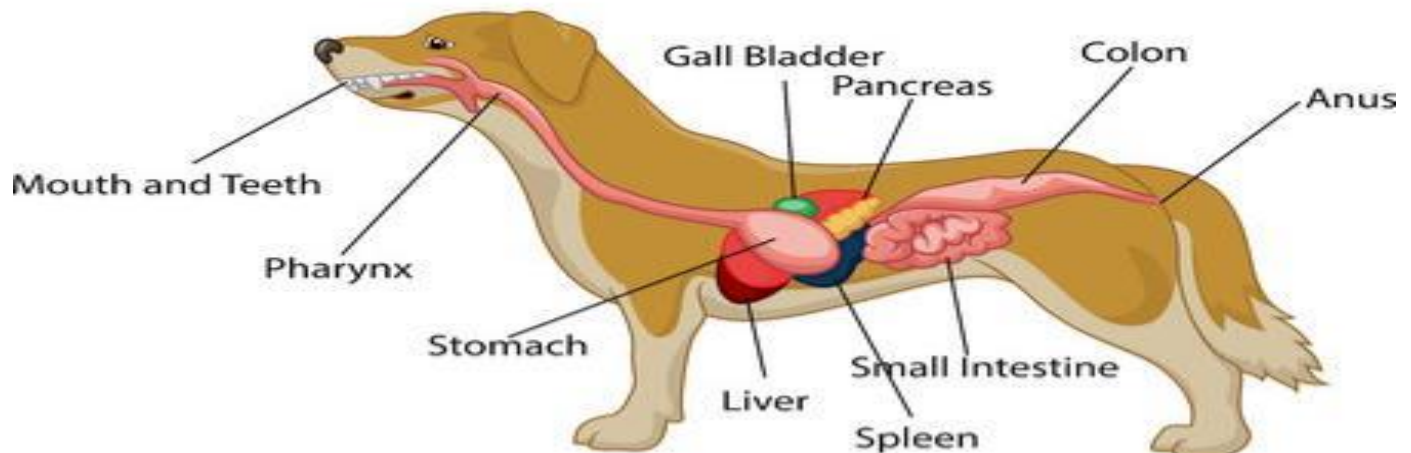
A cow's digestive system is not adapted to eat grass.

The cow will start for searching for another food source to survive.

Adaptation of the digestive system of dog :

Its eat meat it is much easier to be digested, so dog

Has a short digestive system, Dog has sharp teeth that are suitable for eating meat.



The human respiratory system

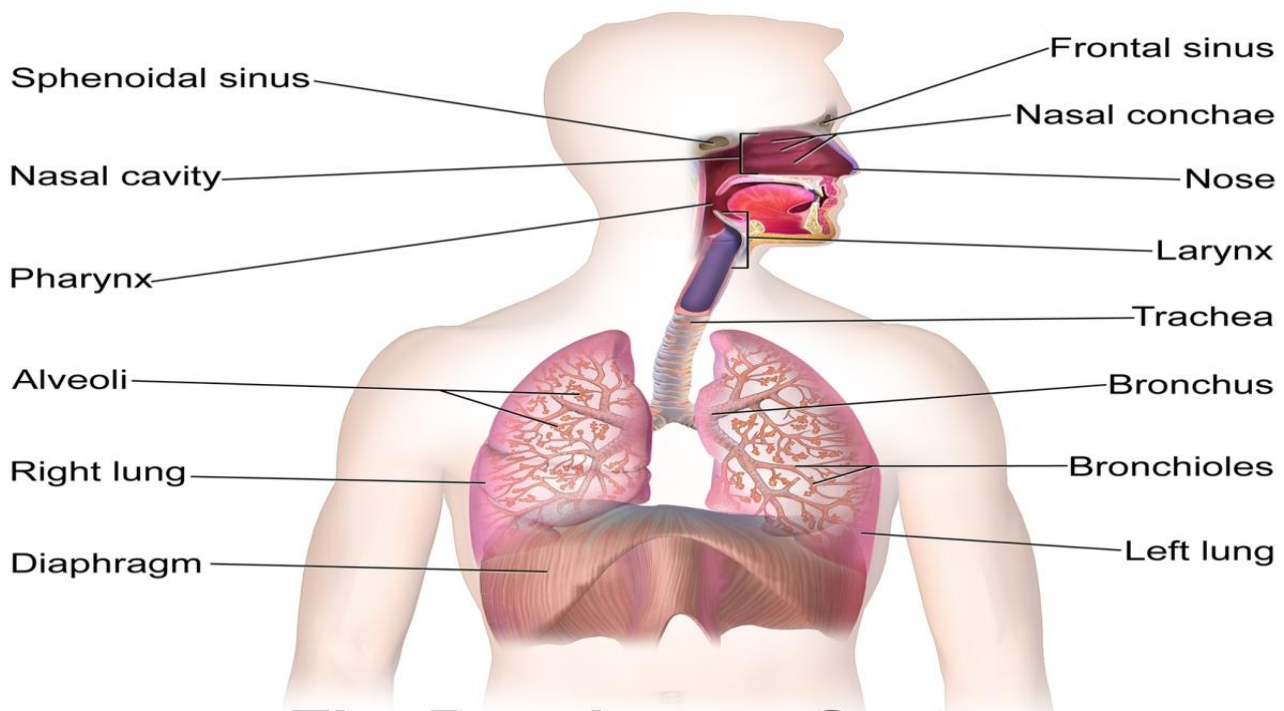
consists of some organs : Nose _Throat (pharynx)
_Trachea _Diaphragm _Two lungs

Our body needs oxygen from the air to be able to do different activities. **Oxygen gas** is very important to our body .

It is responsible for the entry of oxygen gas and getting rid of carbon dioxide gas.

Respiration

A process of entering the air with oxygen in human body and pushing the air with carbon dioxide



The Respiratory System

How does the respiratory system work ?

During breathing in (inhalation) , air enters through the nose and mouth then down the throat. Then, the air passes through the trachea into the two lungs which fill up with air like two balloons. At the ends of these tubes there are "alveoli" surrounding by blood vessels, the oxygen gas go from the alveoli to the blood vessels and it gives the alveoli carbon dioxide , then it can be carried around the body to give it energy

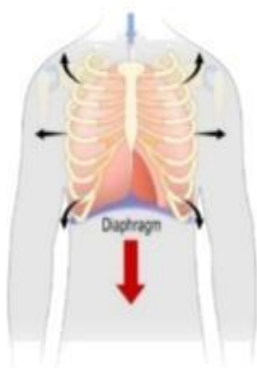
Respiration process includes :

1. Inhalation (breathe in).
2. Exhalation (breathe out).

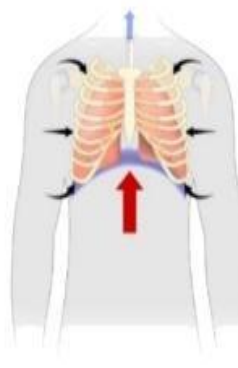
Inhalation and exhalation are directed by a large muscle called the **diaphragm**.

Comparison between inhalation and exhalation :

1. Inhalation process



2. Exhalation process



P.O.C	Inhalation process	Exhalation process
Definition	A process by which the air rich in oxygen gas enters the lungs through the nose .	A process by which the air rich in carbon dioxide gas and water vapor is expelled outside the lungs through the nose .
Diaphragm muscle	It contracts and moves downwards .	It relaxes and moves upwards .
The ribs	Moves upwards .	Moves downwards .
Size of chest cavity	Enlarges in size .	Becomes narrow .

Carbon dioxide gas which is produced during respiration process is a waste. This gas is harmful to our bodies so, we must expel it out during exhalation.

Why We can't hold our breath for a very long time? .

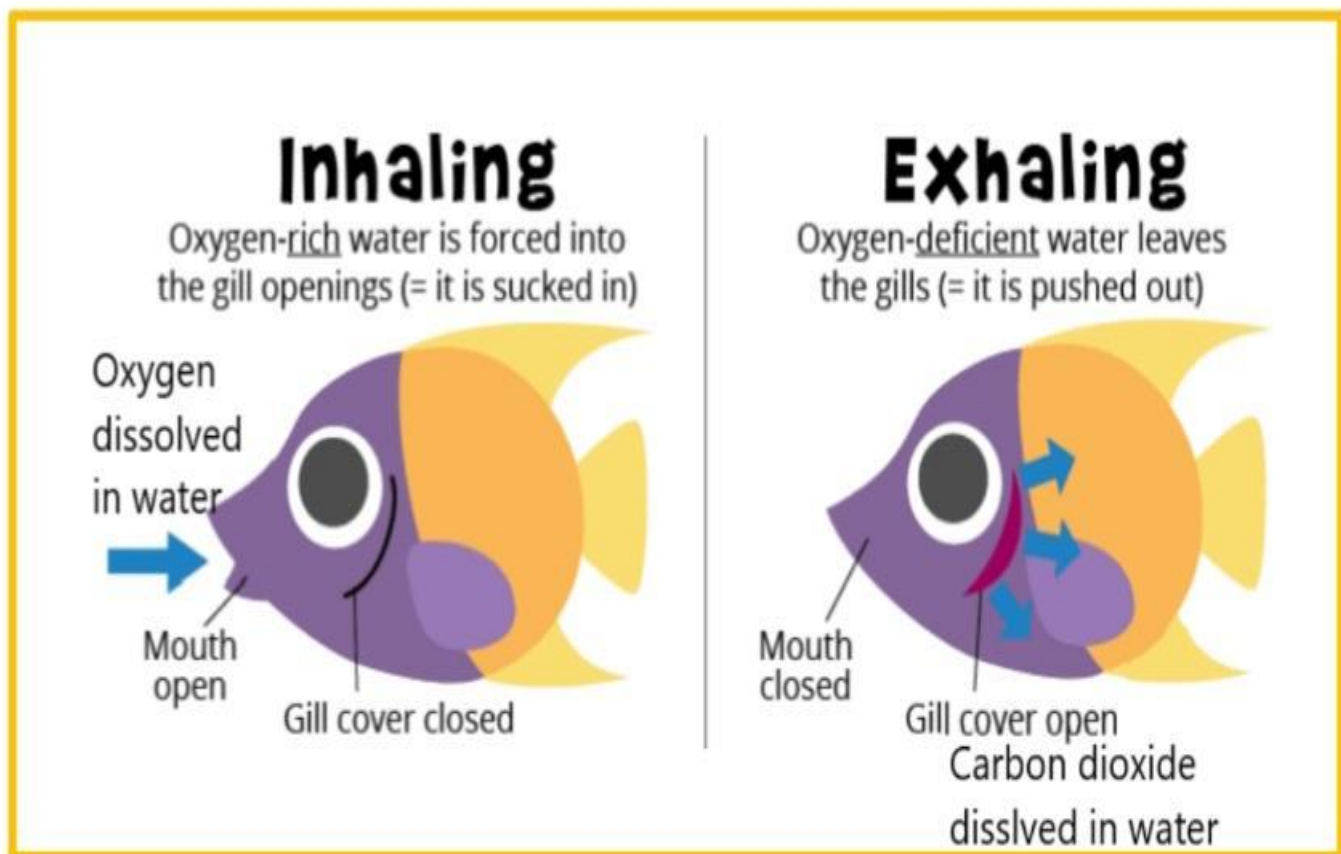
Because we can't inhale oxygen and expel out carbon dioxide so the body can't perform its vital process

How can you keep the respiratory system healthy ?

Breathe clean air. _Avoid smoking and smoking areas. _ eat fruits with vitamin (c) like orange, guava

Lesson (5) How the fish breath

- Fish use **gills** to take in oxygen gas and get rid of carbon dioxide gas.
- Gills are found at both sides of the fish's head, they open and close to allow gases in and out.
- Fish take in water from their **mouth** and allow water out from their **gills**.
- **Blood vessels** in the fish's body give blood to all body parts.
- **Gills** are considered an example of **structural adaptation** which allow fish to live, survive and breath under water.



Humans Change the Environment

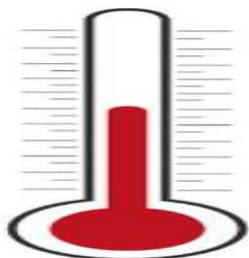
What happens as these environments continue to change ?

- If change occurs **slowly**, organisms have time to **adapt** over many generations , **Rapid** changes can cause many organisms to **move**, **disappear**, **die** or even **extinct** , Human activity often rapidly

extinct means that a living organism is no longer exist on Earth

Some of ecosystem changes are caused by the nature itself, such as :

- 1.Change in temperature.
- 2.The amount of rainfall from seasons.
- 3.Severe weather events, Such as winds
- 4.Wildfires and floods change the Nature of plants , causing increases or decreases the **predators** and **prey**



Some of ecosystem changes are caused by the human activity, such as :

- 1. Cutting down forests.**
- 2. Plowing grasslands.**
- 3. Introducing plants, animals and Diseases that were never part of the Ecosystem.**
- 4. The exhausts from cars and some Factories cause air pollution.**
- 5. Bad habits, such as throwing waste Materials in waterways cause water Pollution.**
- 6. Watering the soil with polluted water make soil pollution.**



- **Plants and animals are affected by changes in an ecosystem by :**

plants and animals may undergo structural and behavioral adaptations to change in the ecosystem. Some animals move to another ecosystem to survive, Plants depend on their seeds to land in a better place for them to survive and grow

- **Humans are also affected by changes in an ecosystem, where :**

- Air pollution makes the human hard to breathe.
- Water pollution makes the human hard to find clean drinking water
- Air, water and soil pollution make the crops cannot grow.

Why the pollution levels are dangerous ?

because exposure to high levels of air pollution over a long period of time can damage the lungs and cause **asthma** and **heart problems**.

The role of human to help restore ecosystem by :

- Replanting the cleared forests.
- Removing the pollutants of air and water.
- Preserving plants and animals in these ecosystems.

Lesson (6) Careers and adaptation

Amphibians :

They are small animals can live in moist environments like rainforests, stream and ponds.

Such as **frog _ toad _ salamanders**



- adult amphibians can breathe using lungs and they can take in oxygen from water.

How amphibians got oxygen from water ?

- Amphibians are covered with skin that allows water and gases to pass through Water surrounds the **skin** making their skin **moist**, so they can absorb oxygen from water.

• Frogs are very sensitive to the effects of :

Water and air pollution _ Destroying the natural
Viruses that can travel through water

**Scientists are working to save many types of
amphibians from extinction like golden frogs in
rainforests by studying :**

- How these animals interact with their environments.
- What make these animals sick in their environments.
- The reasons of the disappearance of these animals

Q Note

Ninety species of amphibians have become extinct in the last 20 years in addition to 124 other endangered species

To protect amphibians from extinction as follows :

Biologists: study how amphibians breathe in air and water helps scientists search

People: lean air and water is important for amphibians, so people should

- Avoid throwing waste materials in water.
- Dispose of chemicals in a correct way helps to avoid water pollution.

senses

Animals **see** with their eyes and **hear** with their ears, just as humans do, but some animals have a **strong sense** of **hearing** or **sight**, or their strength lies in some other senses, and they can **communicate** with each other by sound or movements.



VISION



HEARING



SMELL



TASTE



TOUCH



The Egyptian mongoose :

*depends on its communication method by **issuing a set of sounds**, which allows the transmission of messages to other animals when moving from one place to another or when searching for food.*



The superior abilities of the dolphin's senses :

*The dolphin uses the echolocation sense to locate things under the surface of the water, where it releases **high-frequency** clicks that travel through the water and return to it in the form of an echo, which locates the prey and other objects.*



nocturnal animals :

*These animals are active at night because in very hot areas, the best time to go out for the purpose of **searching for food** is at night, and some animals **hunt** at this time due to the availability of food at night only, and some animals depend on **darkness** to be able to hunt their prey*

nocturnal animals



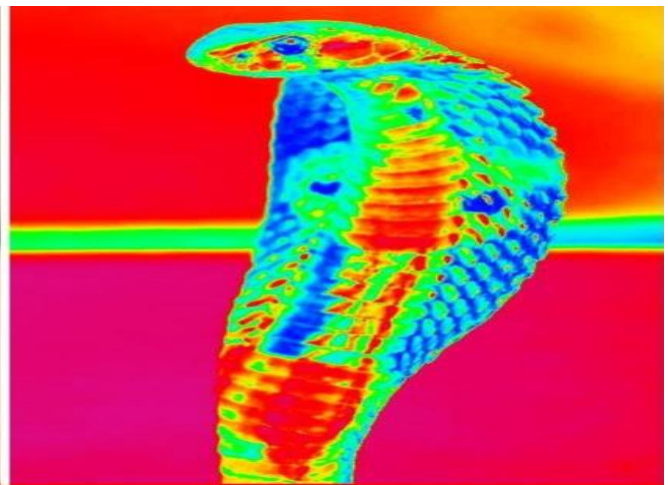
The Super sensory adaptation allow these animals to move in the dark like :

Snakes:

*they can sense **heat** through a specific part of their face and identify **warm-blooded animals***



Humans Vision

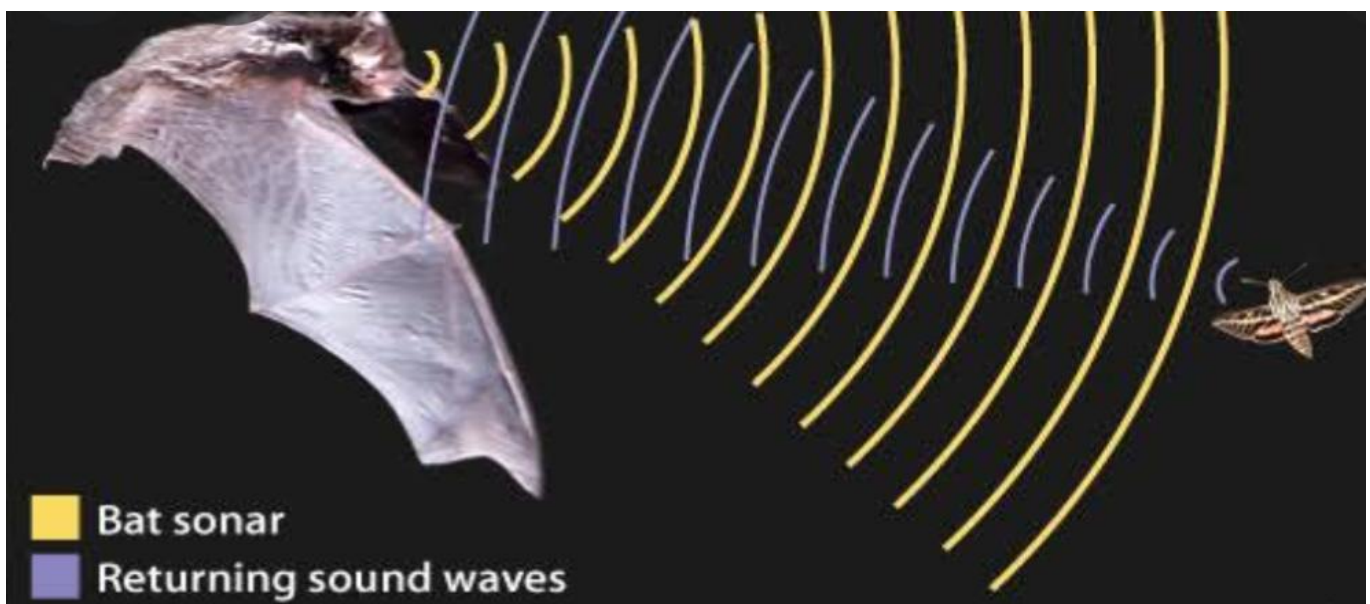


Snake Vision



Bats :

Determines the location by the **echolocation** and this helps her to catch insects in the dark and she can create a map in it's mind to guide her to the place of food



Owls:

*have **exceptional senses of sight and hearing**, and its bowl-like face and feathers on its head help it to direct the distant sounds to the owl's ears even for animals that hide among the grass or under the snow and it has the ability to turn her head in **all directions** .*

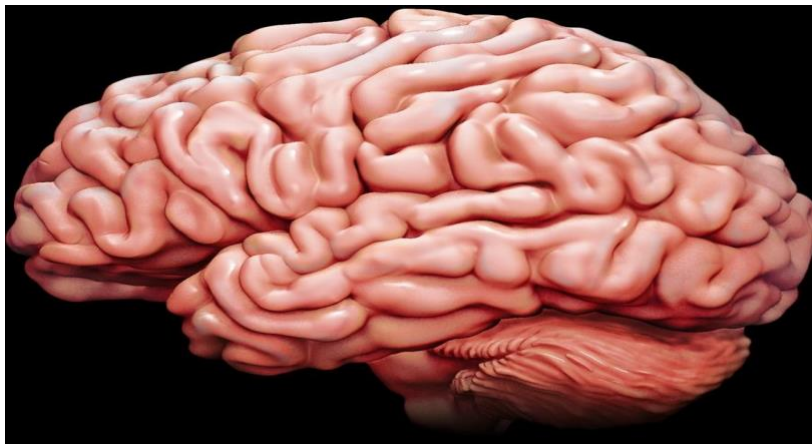


The nervous system of mammals

such as humans, elephants and dogs

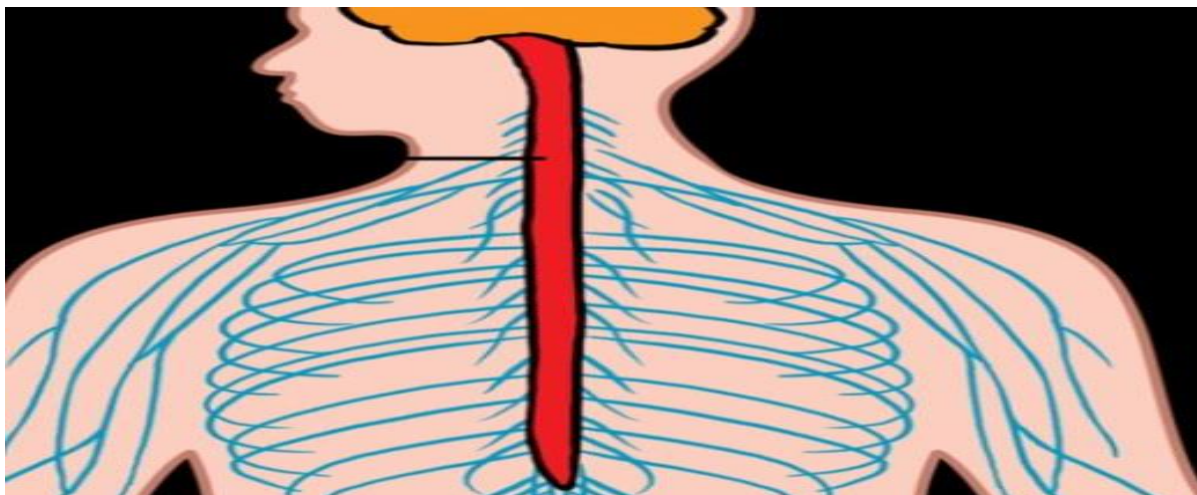
The brain :

It is the body's main control center it is connected to spinal cord



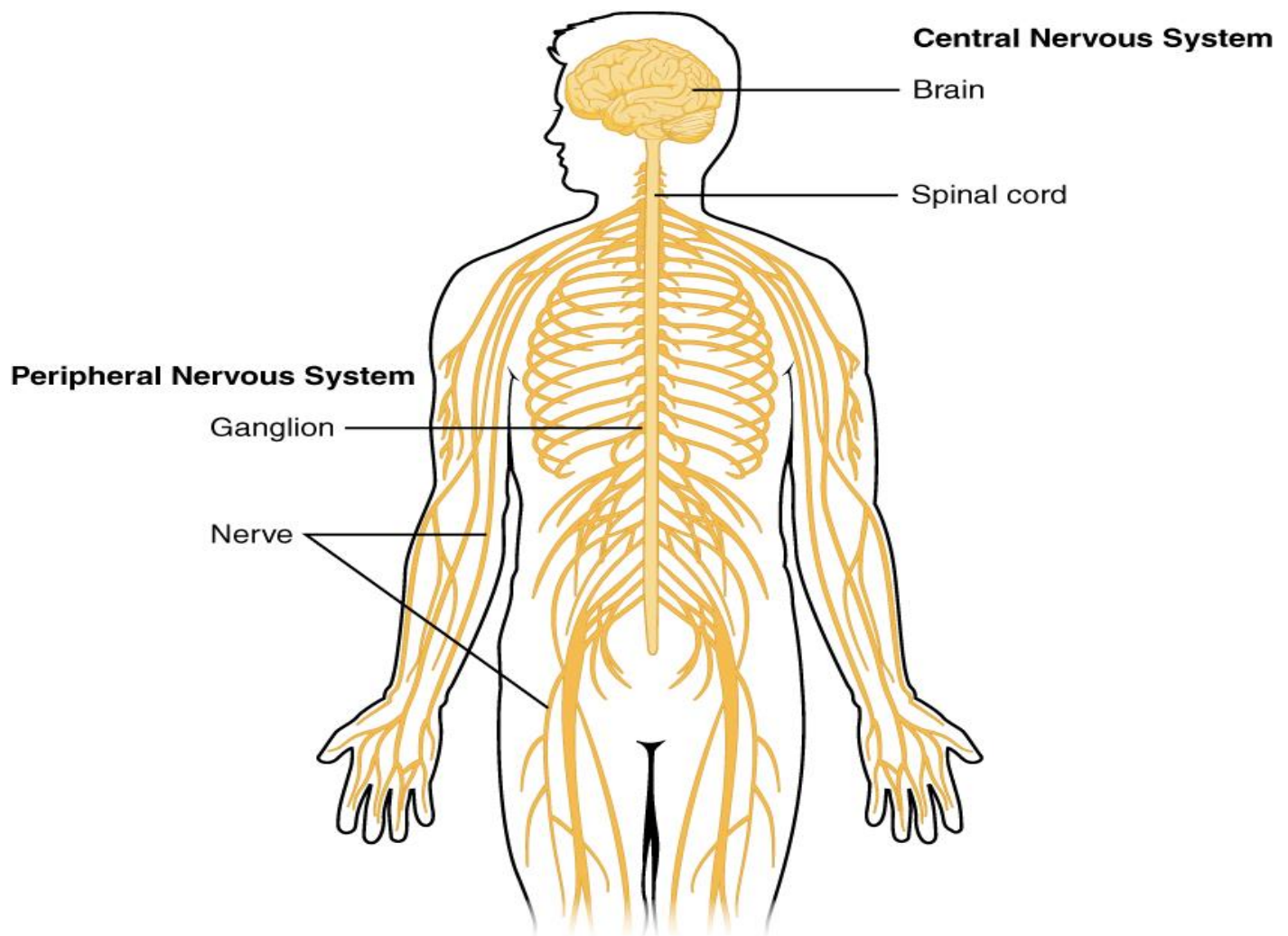
the spinal cord :

carry messages to and from the brain



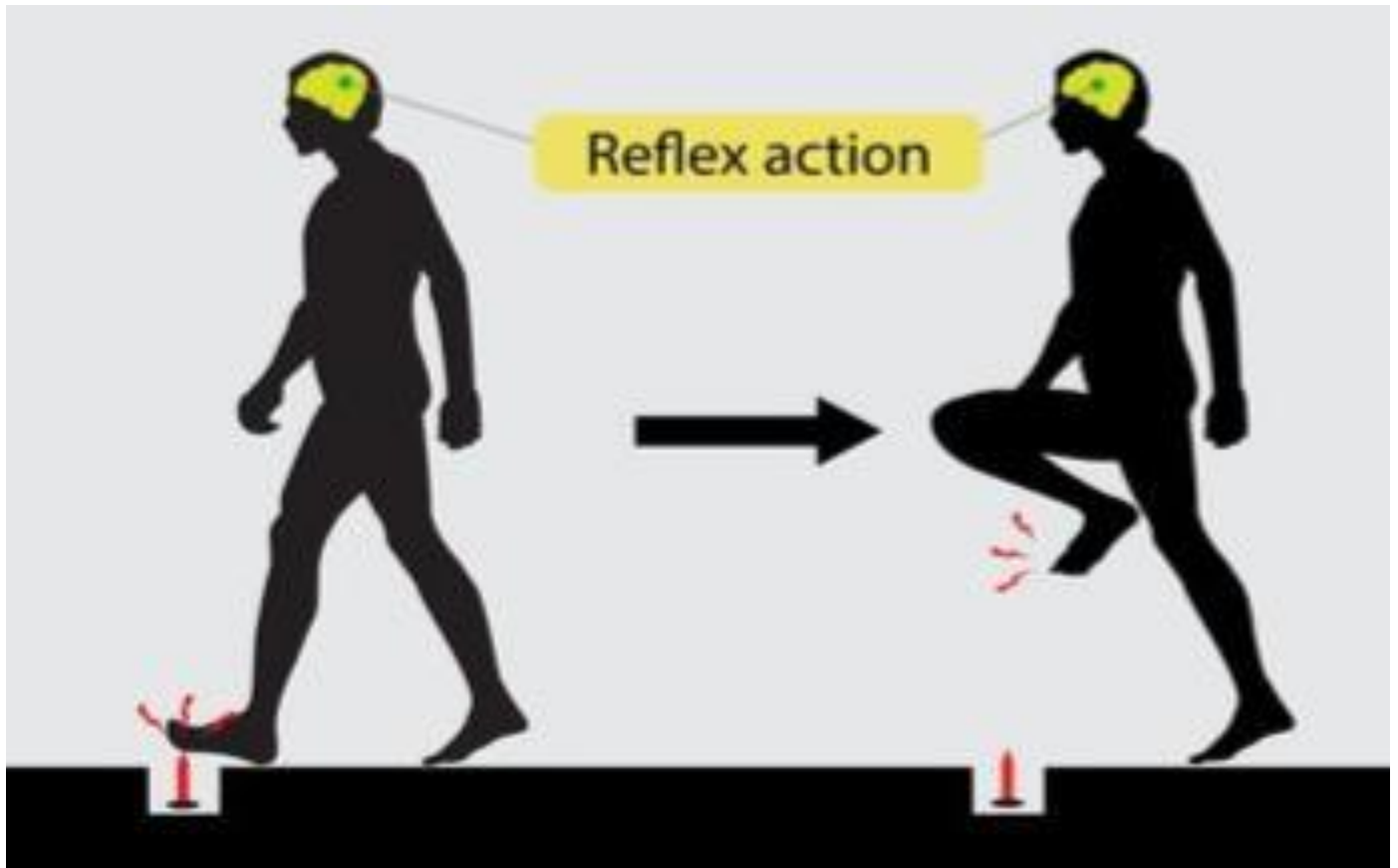
nerves:

Carry messages from the brain to the rest of the brain they distributed from spinal cord and connect to all parts of the body and reach the senses and muscles, and some of them are directly connected to the brain, such as the nerves of the eyes and the heart



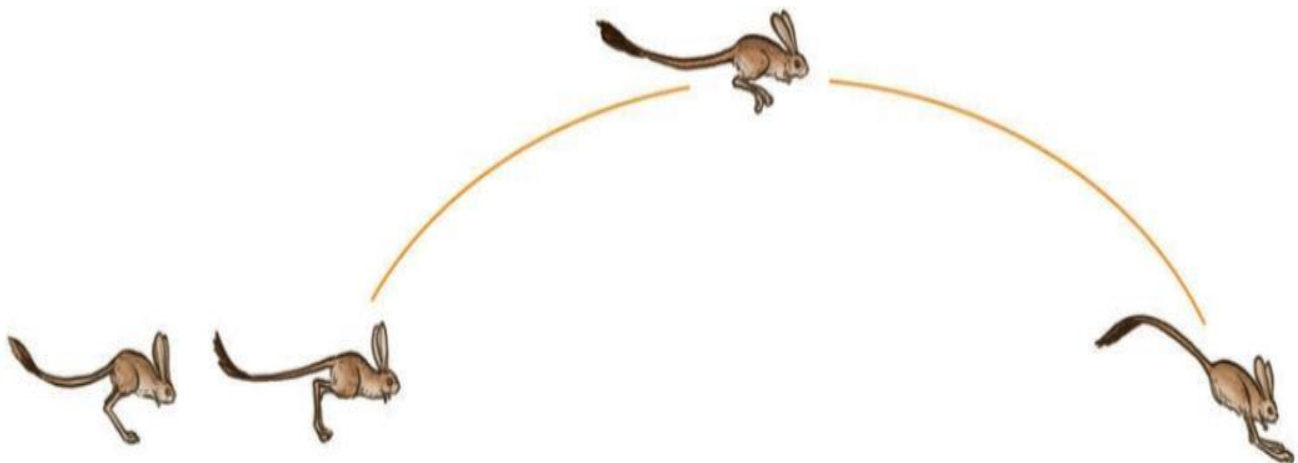
*The sensory organs receive **information** from the environment, and the nerves throughout the body connect the sensory organs to the brain*

*These nerves receive information from the sensory organs and send it to the **brain**, then the brain deals with this information and sends a **reaction** to it*



The Egyptian jerboa

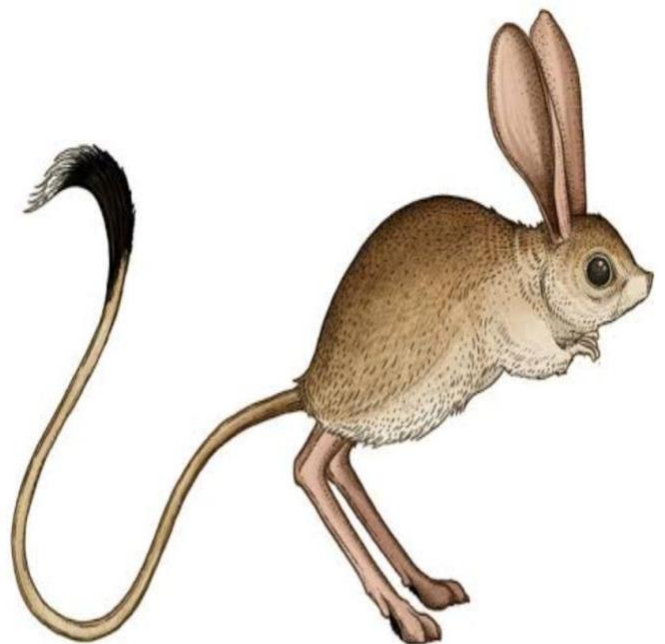
*is a rodent, and its body looks like a mixture of different animal parts because its **legs** resemble the legs of a **kangaroo** until it jumps for a distance of **3 meters at a time**. It has **hairy feet stuck in the sand** and jumps in zigzag patterns and depends on its **large ears**. If it hears danger it escapes quickly*



The jerboa remains attentive and listening while searching for food

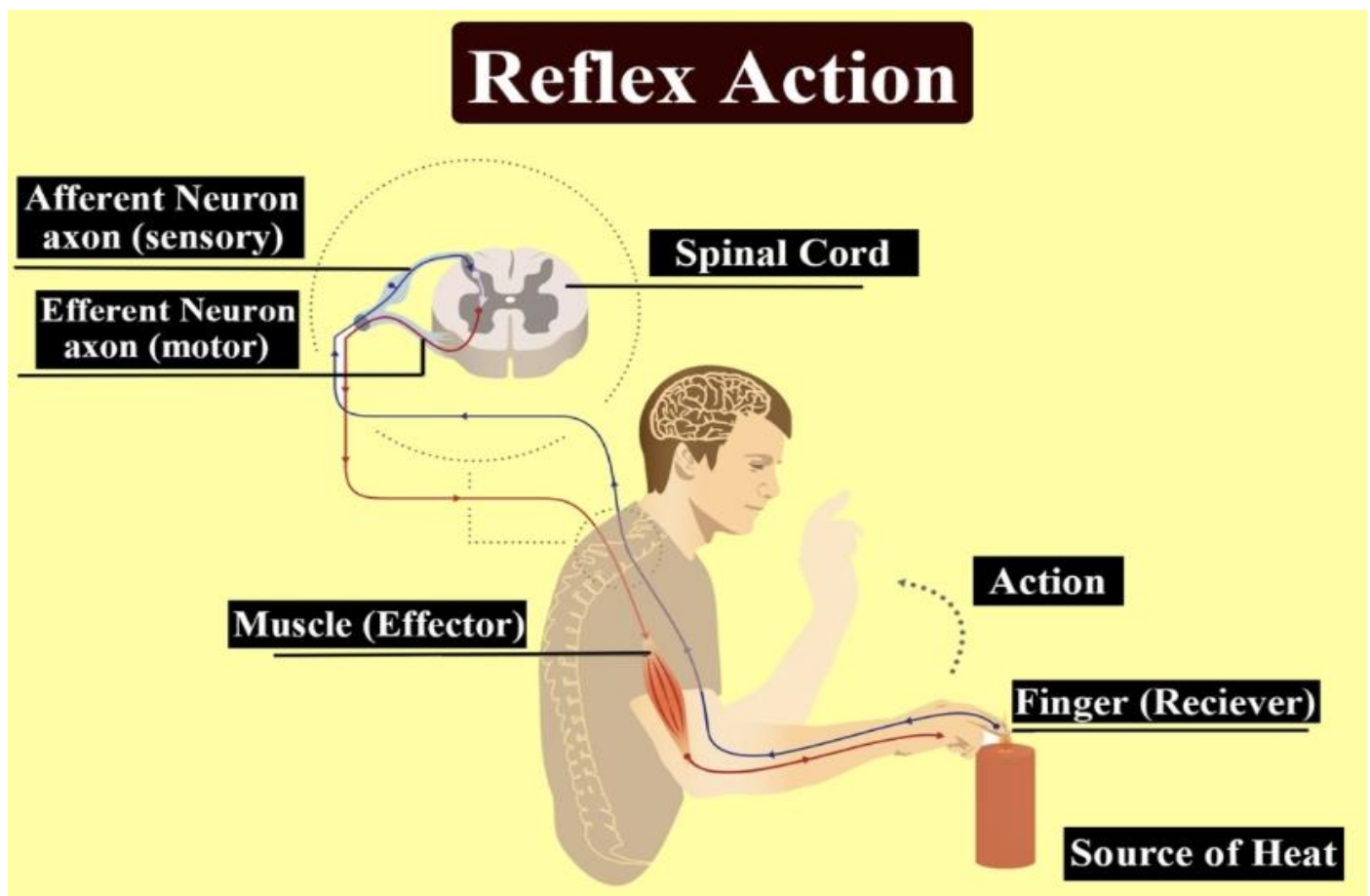
*When **snakes** make **noise**, sensory receptors in the jerboa's ears send a message through the **nerves** to the **brain**, and the brain translates this message and alerts the jerboa's legs to start moving quickly and this process occurs in less than a fraction of a second*

*The time it takes for the jerboa to respond is called the **response time***



How the nervous system works

*Sensory organs such as **eyes**, **ears**, and **skin** are responsible for collecting information, then the nerves send this information to the **brain**, and the brain processes the information and then sends a **signal** to the body about what to do and it is very fast and this is called a **reflex***



*Some messages are transmitted to and from the brain automatically, such as **breathing signals***



Exercises

- 1. An owl can wrap its head in (one way _ two directions _ all directions)***
- 2. Egyptian jerboa from (reptiles, rodents, birds)***
- 3. Bats determine the place by (vision - echo sound - jumping)***
- 4. Nocturnal animals are active (day - afternoon - night)***
- 5. (The jerboa - dolphin - bat) emits high-frequency clicks***
- 6. The spinal cord is located in (brain - eye - spine)***

7.The leg of the Egyptian jerboa resembles the legs of (mouse. _ kangaroo _ cat)

8.(The digestive system _the nervous system _ the respiratory system) collects and sends information.

9.From the nervous system (heart - brain - cat)

10.The response time of the jerboa (slow - medium - fast)

11.The jerboa can sense the presence of (cats - snakes - current)

Complete

1..... The member responsible for hearing

2..... The member responsible for the vision

3. An owl picks up distant sounds thanks to its....which looks like a bowl

4. The animals that locates by echo.....,

5. Nerves transmit information from ,

6. The owl can turn his head in..... directions

7. The brain is part of.....

8. Is the control center of the human body

9. Snakes can see.....of bodies

10. Some animals depend on..... to hunt prey

11. The stems of a jerboa are similar to.....

12. The mongoose producesto communicate with the animals

Give reason :

1. **The owl's head looks like a powl?**

.....

2. **The dolphin makes echolocation?**

.....

3. **The jerboa has legs like kangaroo?**

.....

4. **The jerboa has big ears?**

.....

5. **The bats create a map in her mind?**

.....

6. **The snakes can identify the warm
blood animals?**

.....

7. The dolphin release high frequency clicks?

.....

8. The nocturnal animals are active at night?

.....

9. The body can make reflex action?

.....

10. The jerboa remains attentive and listening while searching for food?

.....

How the dolphin make echolocation?

.....

Can you explain

The human can't see in the dark they need a
night vision goggle



but some animals have **spectacular** night vision which enables them to see at night like **fishing cat** and **Tarsier monkey** :

Fishing cat : it's wild cat has structural adaptation in its eye seems to **glow** in the dark because they have mirror _ like membrane on the back of their eyes **So** when light enters its eyes it bounces of this membrane allowing the eyes to collect more light that's causes the eye to appear bright to find its preys in the dark



Sources of light

Source of light :it is something that gives off its own light.

Like the sun _ electric lamps _ candles _ flash lights _ fire

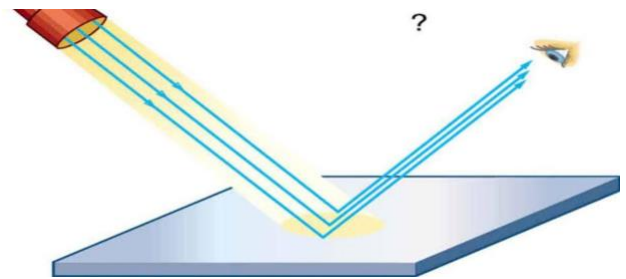


Sources of **L**ight

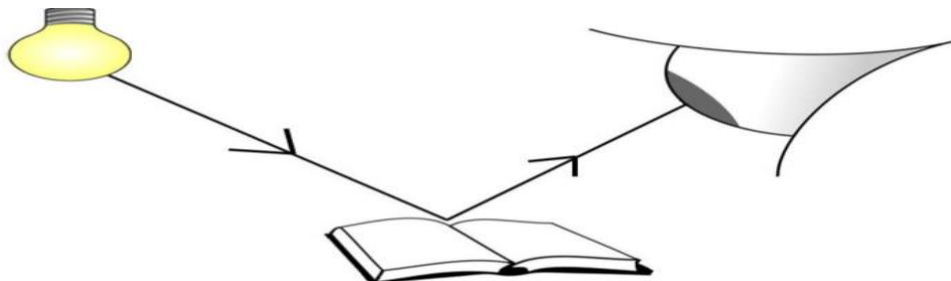


There is some objects that reflect the light so they not considered as sources of the light like

The moon _ mirrors



How we see? We can see objects due to the presence of the light that fall on objects and bounce of these objects to the eye to see them

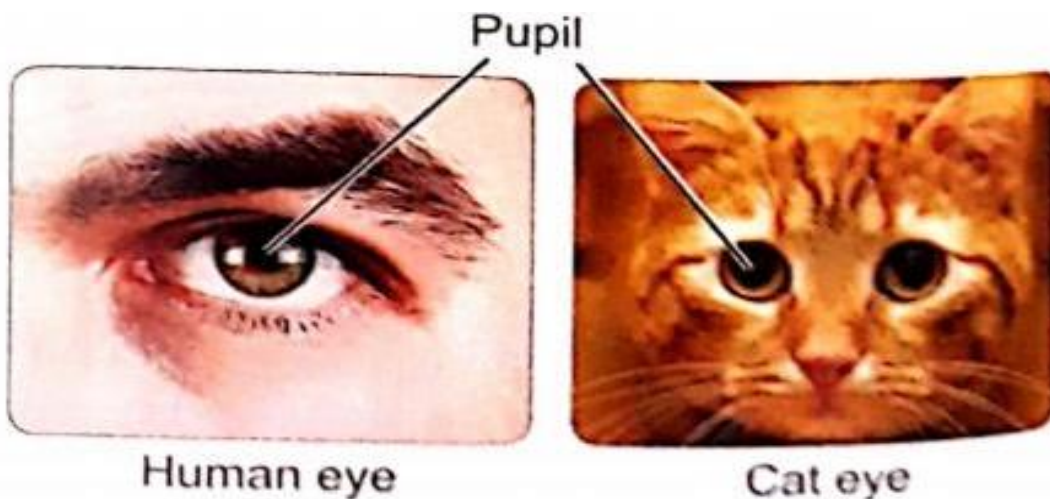


Lesson 2

Hunting in the dark

The difference between the eyes of the human and the nocturnal animals that the animals have bigger eyes which are more sensitive to the light

Because the pupils of their eyes usually open wider than the pupil of humans to allow more light enters their eyes



Note : nocturnal animals can detect the weakest light level, but in the complete dark they depend on their other senses such as **hearing, touching, smell** to hunt and move



The Tarsier

Environment : Southeast Asia

Type : primate monkey from mammals

Length : about 10 centimeters not including the tail

Its food : insects, small lizards or birds

Its structural adaptation : like Owls adaptations as :

1. **Eyes** : has huge eyes like Owls to gather and reflect any light to give it picture of its surrounding
2. **head** : can turn its head 180 degree like Owls to focus on distant or near objects



Lesson 3

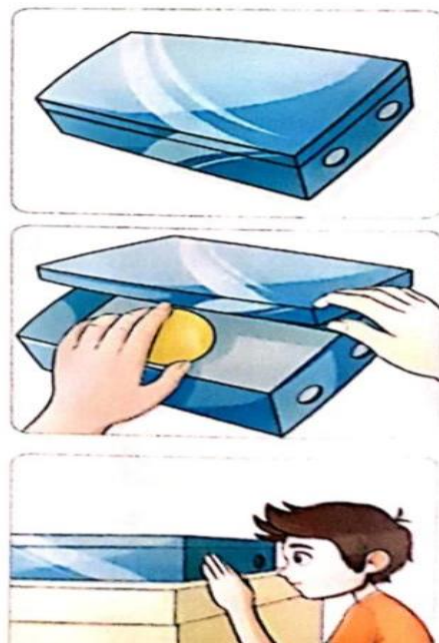
Activity : Light observation

► Steps

1. Make two holes on one side of the box next to each other so that the distance between them is approximately 5 cm.

2. Place the ball inside the box and close it.

3. Cover one of the holes with your hand and look through the other hole to see the ball.



► Observation

You won't be able to see the ball.

4. Take your hand away and replace it with a turned on flashlight, and look again through the other hole to see the ball.

► Observation

You will see the ball clearly.

► Explanation

- We wouldn't be able to see the ball when the box was completely dark, because there is no light source and also the ball don't emit light.
- But, when there is a light source, we can see clearly, because the light from the flashlight falls on the ball and then returns to the eye, so we can see.

► Conclusion

Presence of light is necessary for us to be able to see things clearly.

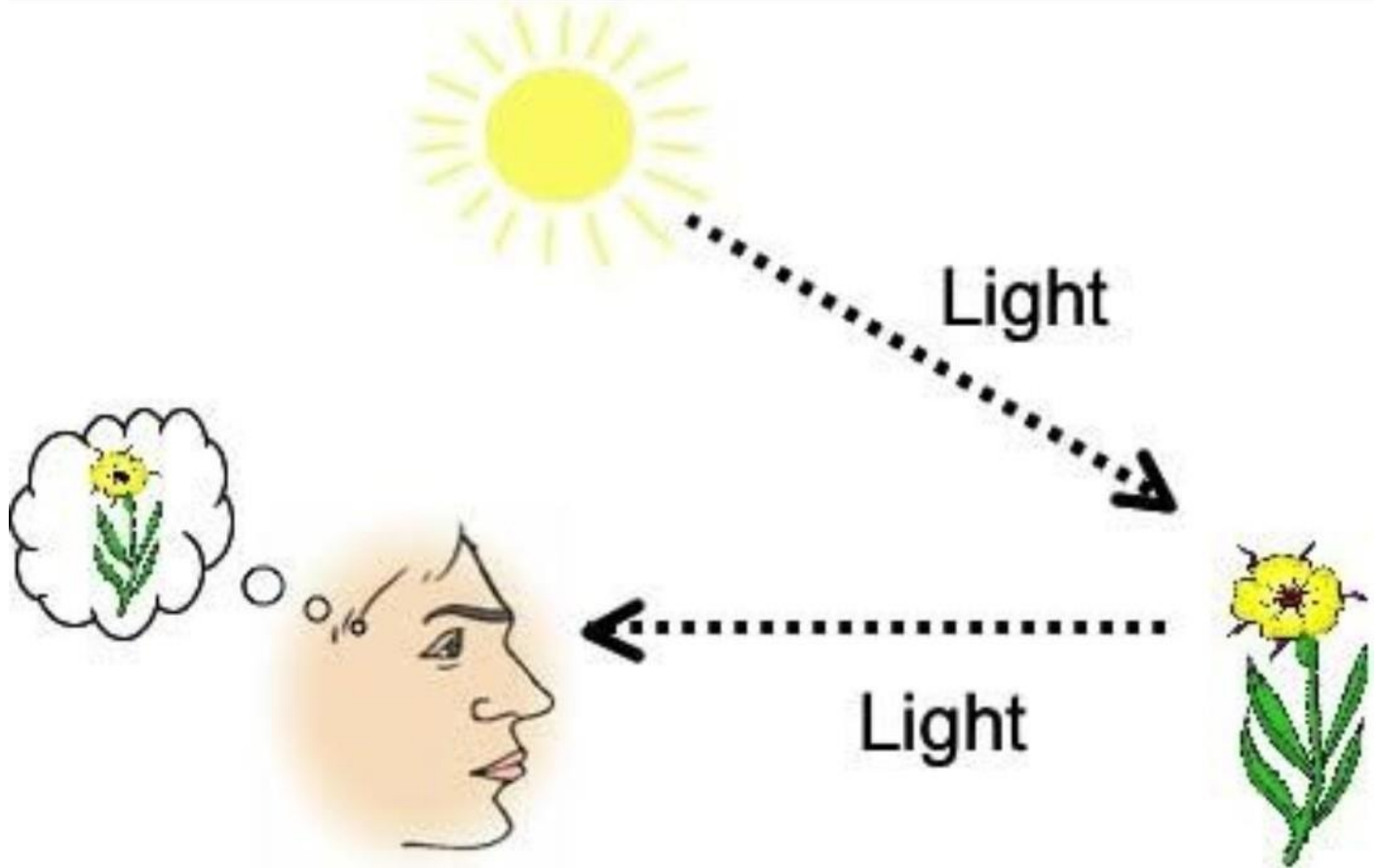


Light is energy

Light : it is a visible form of energy that travel in the form of waves

In order to see an object :

Light must fall on objects and reflected into the eyes, the eye transmit message to the brain and it interpret the information and tell the human what they are seeing



Special eye structure

Deer , horses, cats and dogs have a feature called tapetum lucidum

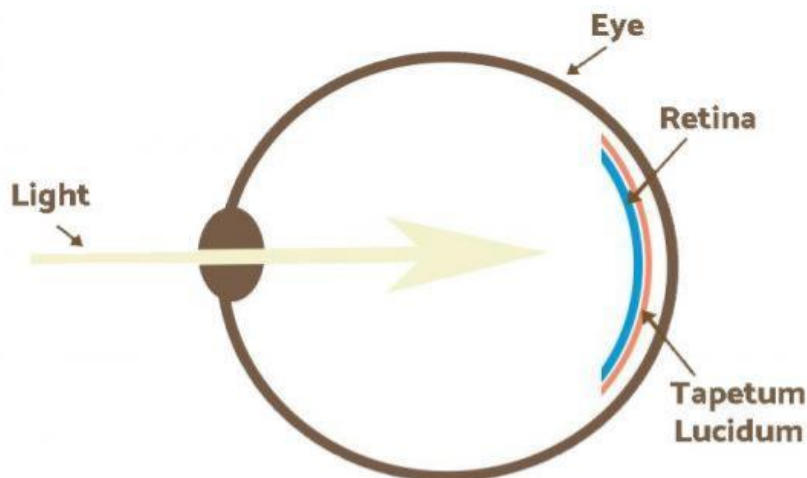
Tapetum lucidum : is a thin reflective layer at the back of some animals eyes that reflect the light

It help animals to :

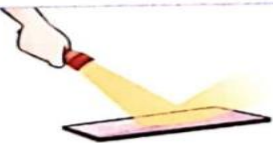
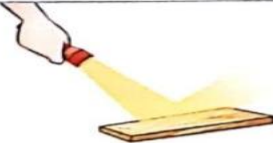


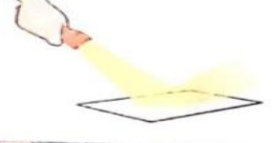


- 1.see and hunt at night
2. Avoid being hunted at night

When the light enters the eye and fall on the tapetum lucidum layer it bounces off it like mirror And that make the eye **glowing** of the cat's eyes

- The light that the eye not detect at first passes through to the tapetum lucidum and bounced back for second time that make the eyes get more amount of light at night



Lesson 4 activity on Reflection

Materials	Figures	Observations
The piece of plastic.		Plastic reflects small amount of light rays.
The piece of wood.		Wood reflects small amount of light rays.
The piece of cloth.		Cloth reflects small amount of light rays.
The mirror.		Mirror reflects large amount of light rays.
The paper.		Paper reflects small amount of light rays.
The piece of metal.		Metal reflects large amount of light rays.
The piece of glass.		Glass reflects very small amount of light rays.

► Conclusions

- Shiny and smooth materials (such as : mirror and metal) reflect light better than the other materials.
- Rough materials (such as : plastic, wood, cloth and paper) reflect light less than smooth materials.
- Transparent materials (such as : glass) reflect very small amount of light.

Light strikes matter

The light travels in straight lines and when it hits an object :

- _ Some of light energy absorbed
- _ Some may go through the object
- _ Some reflects off the object's surface

Opaque objects : They are objects that don't allow light to pass through the body

Ex). Plastic, wood, metal, and **human body**



opaque



transparent

Why do you see your shadow?

Because all the light that hits the body bounces off or absorbed so none of the light passes through **body**



Transparent objects :

They are objects that allow light to pass through it

The things can be seen through it

Ex). Water, windows, lenses



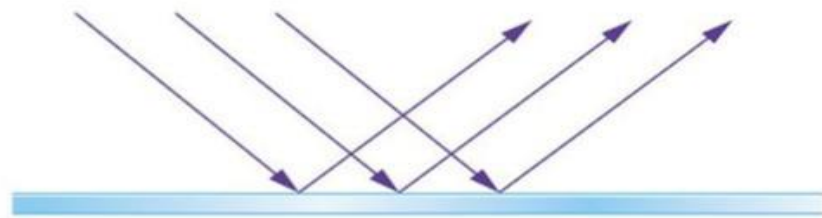
- The reflected light depends on the **smoothness** of the surface :

_ If the surface is a **polished mirror**, the rays will reflect at the same angle at which they hit the object originally

_ If it a **painted surface** the rays will reflect in different direction " the rough surfaces scatter light"

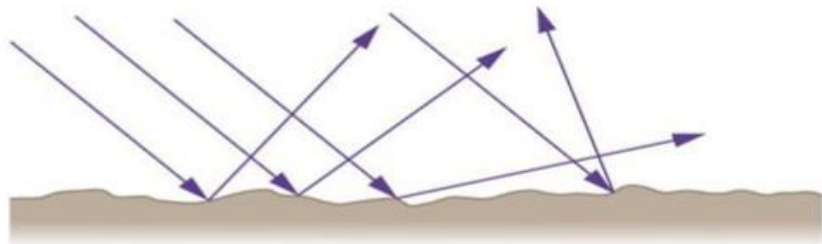
Two Types of Reflection

Flat
surfaces
reflect
perfectly!



(a) Specular reflection

Rough
surfaces
reflect all
over the
place!



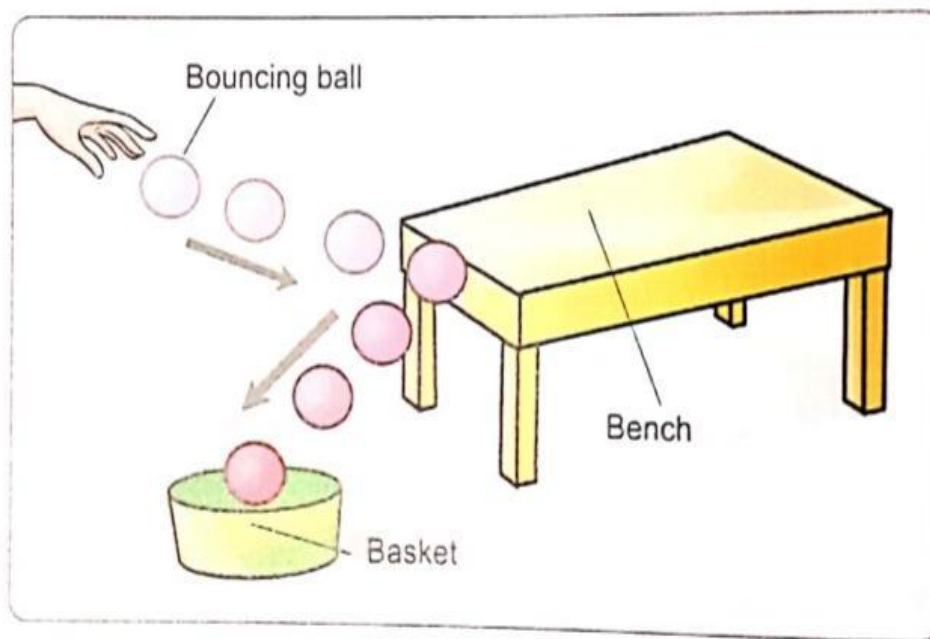
(b) Diffuse reflection

Lesson 5

Sight model

- **Now**, let's make a model to show how the reflection of light affects the sense of sight.

- ▶ Imagine using a bouncing ball to model how the eye see the reflected light.



- ▶ In this model, if the ball bounces off the bench and go into the basket. According to this model, try to choose the correct answer in the following questions :

- The bouncing ball represents (light rays – the eye – an object)
- The bench represents (light rays – the eye – an object)
- The basket represents (light rays – the eye – an object)

- ▶ From the previous model, we conclude that :

Light reflects off an object into the eye, so we see the object.

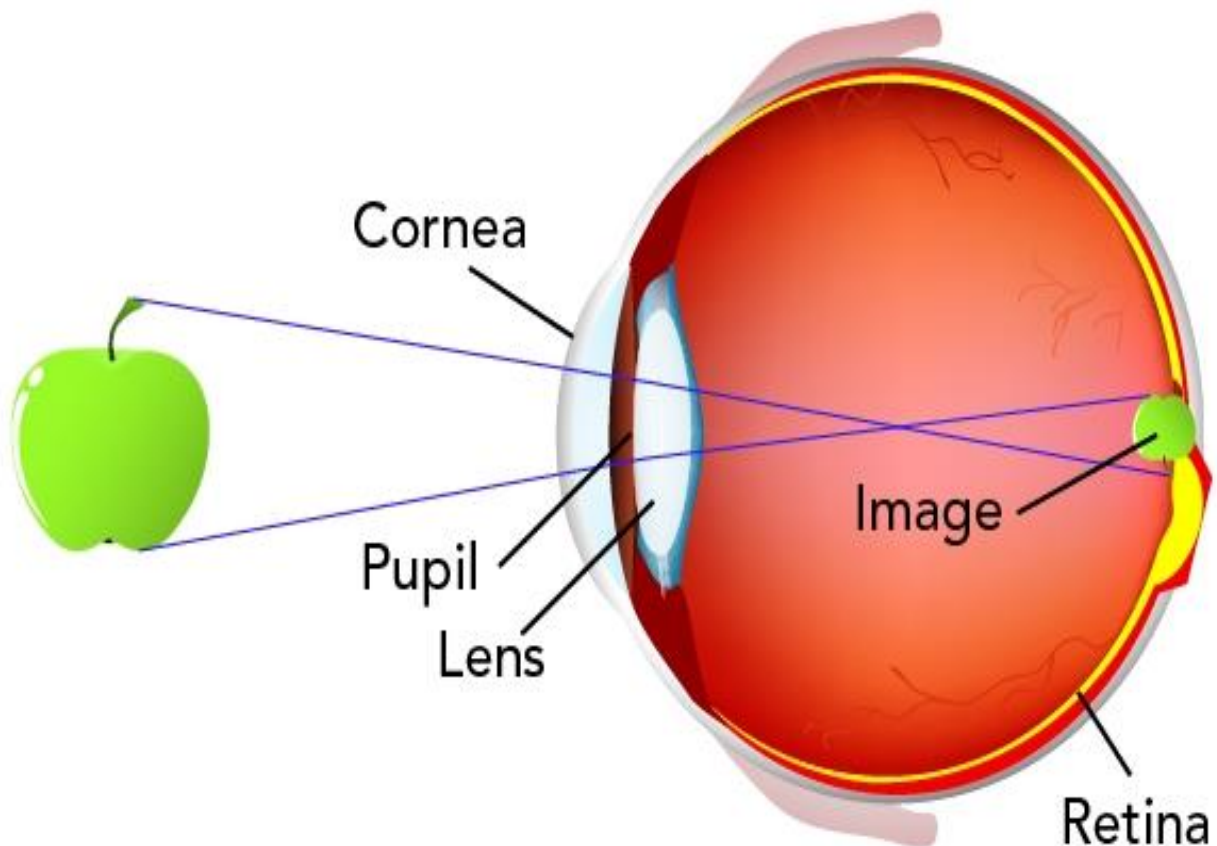
Lesson 6

In action

What happens when light reaches the eyes ?

The lens inside the eye bounces the light that falls on it onto the back of the eyes

When it focuses light it collects light in a point so you can see different things



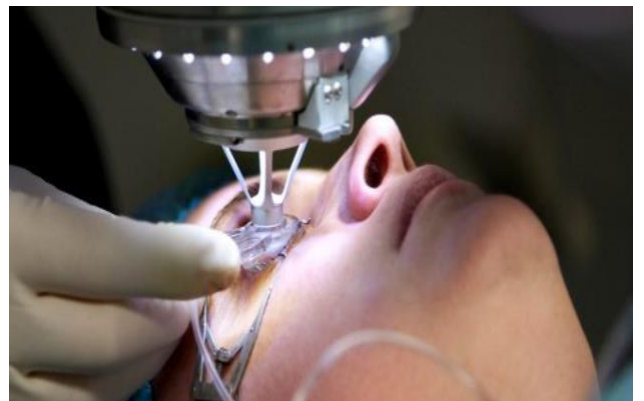
How do optometrist help us?

If the lens does not focus light properly the person may have blurry vision and make

- _ some people can't see far objects
- _ some can't see near objects
- _ some have difficulties to distinguish between colors

So, **optometrist** test the eyes of these people and determine how to correct the vision by different ways as :

1. Using glasses or contact lenses
2. Using laser surgery



Concept 4 : communication and information transfer

Lesson 1 : can you explain?

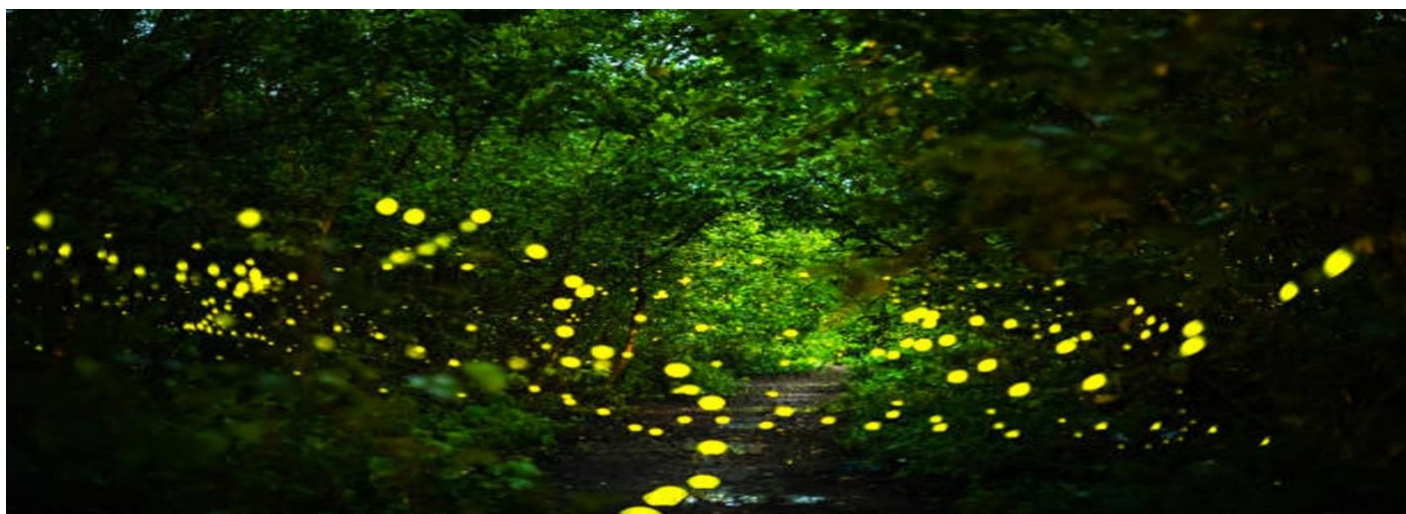
The human can use their **senses** to gather information about the environment like **speaking, writing, reading**. but animals can use **light** and **sound** to send and receive information

Fire fly light show :

1. Fireflies beetle produce chemical reactions to flash light by using their **wings** to **warn off predators** or to **attract a mate**.
2. They flash at regular intervals, but if there is another group of fireflies they will change their own patterns to match with the other group to communicate.

The interaction between human and nature :

_some artists set up lights in the forest to go on and off at regular intervals or in pattern, large group of fireflies responded by flashing back at the same time.



Alphabet and written language :

People use language to communicate by reading , speaking , writing and the ability to communicate by speech separate humans from animals

The history of the invention of language around the world



The oldest writings appeared in Egypt from 3000 BC.

The ancient Egyptians created the hieroglyphic writing and it consisted of 700 letters.

The Egyptians invented papyrus paper for writing.



In the year 105 AD, the Chinese man, Cai Lun, invented paper from the inner bark of mulberry and bamboo trees.



At the beginning of the 15th century BC, many cultures improved the writing system using letters after that letters were developed into the alphabet.

The Babylonians in Mesopotamia
(Iraq) created the cuneiform writing.



The Maya peoples of Central America established
their writing system in the early 300 BC.



The Mayans made paper
from tree bark coated with
lime.

Lesson 2 : *songs of whale.*

Humpback whales sing under water to communicate with each other they sing a wide range of tones and different sounds depending on season where :

In winter " mating season"	In summer
It sing with high pitched sound like "the voice of women"	In low pitched sound like "voice of mens"
The high pitched sound travel better in cold water	The low pitched sound sound travel better in warm water

And they sing different songs in the feeding seasons



Transferring information :

The senses such as hearing, smelling, sights, touching and tasting are used to collect information about the world and to communicate with each other.

► The different kinds of information that the eyes receive :

- Our eyes can detect light that travels very fast through the air, this means that our eyes can detect signals that travel very fast over different distances such as :

1 When someone waving at you from a distance, you see him and understand what he means.



2 When your eye see a red traffic light, it sends a signal to stop.



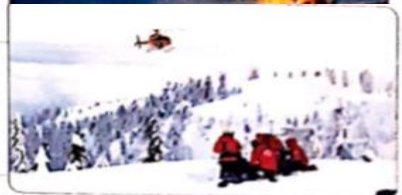
3 People use a rescue flare to communicate with each other.



4 People use signal fires to communicate over distances of many kilometers.



5 Many hikers (travelers) use mirrors for flashing to attract the attention of rescue helicopters and communicate with them.



6 Lighthouses encode information in flashes of light that tell sailors where they are.



The code: is a pattern that has a specific meaning agreed upon by the sender and receiver.

Language is code in the form of sounds and writing is code in the form of symbols

and people use the code to transmit information, such as raising the thumbs up or down.



There are many codes such as sea light tower, drums, traffic lights, and facial expressions.



Lesson 3: morse code

Morse code



Samuel Morse developed it in the 19th century.

It consists of dots or dashes, or whistles (long or short) and the group of them represents a specific letter or number.

Visual patterns



Sound patterns



Animals use motion as a means of communication.

Humans use sound and light to communicate, and animals use movements to communicate to search for food and water.

► Tools



A flashlight.



Pencils.



Notebooks.



A small drum.

► Steps

1. Share one of your friends to create a unique code (signal) for every letter of the alphabet.
2. Each one of you should write down this code in his notebook.
3. On a separate sheet of paper, write a unique message that is no more than five words (without being seen by your friend).
4. Stand on one side of the room (where you are the sender) holding the drum and your friend on the other side of the room (where he is the receiver).
5. Use the drum to send your encoded message to your friend (the receiver).
6. Let your friend decode your message according to the code you have created.
7. Repeat the previous steps by using the flashlight instead of the drum.
8. Talk with your friend to compare the two messages that he was received even by using the drum or the flashlight to the original message you have wrote in step ③.



► Observations

- You and your friend may have incorrectly sent signals or incorrectly interpreted them.
- Your code may have included the same encoding for more than one letter.

► Conclusion

- We can send encoding message to communicate with each other through different ways such as :
 1. Using light energy that depends on the sense of sight.
 2. Using sound energy that depends on the sense of hearing.

💡 Note

To improve your code you can :

- Simplify your code.

- Make the letters more distinct.

Lesson 4 : Animals communicate with movement.

How the bees communicate with each other :

Bees communicate to find **food** and **water** by doing a **special dance** . It move it **figure 8** pattern by vibrating its **wings** and the other bees can read this code by the sense of **sight** .

Coding with honeybee :

_ The **scout honeybee** make **one round** dance if the flower very close

_make **waggle dance** to right and left if the flower little farther away from the hive.



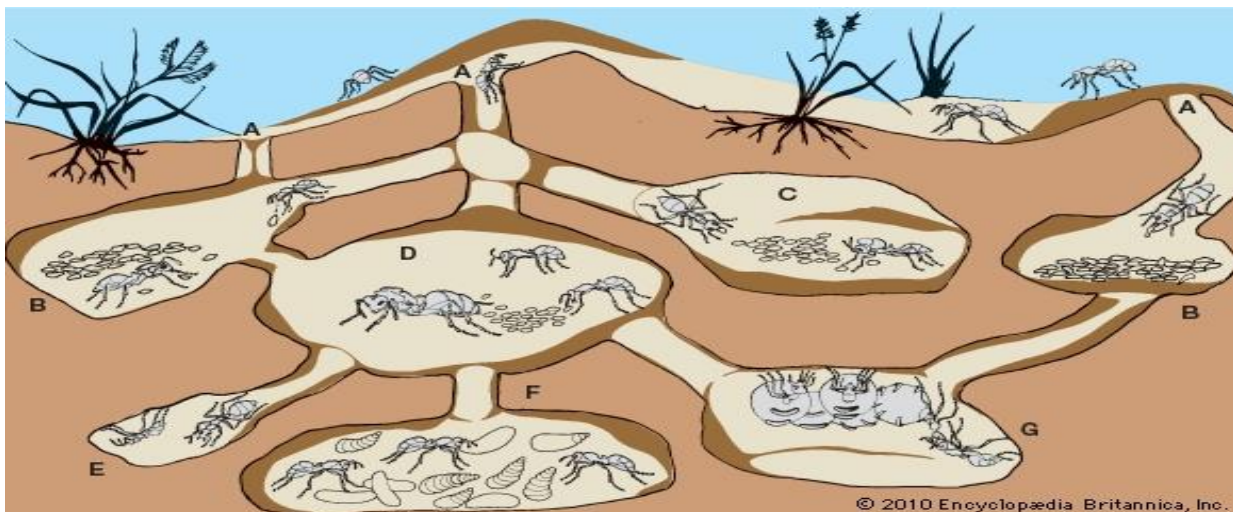
System : is a group of related objects work together to perform a function.

_the cell phone and computer connected to internet and TV connected to the cable TV, they are communication systems depending on signals, there is another parts work to transfer information like, satellite, communication towers, software so the cell phone cannot do its functions by itself because it just a part of this system .

Ants :

Live in colonies and work in system, there's

1. **Nurse ant** : when the food is low it send strong smelly messages to **scout ants** : which responsible for locating food and send a strong smelly message to alert the ants to find food
2. **Soldiers ants** : send smelly message to communicate if there's a danger nearby.



Unit 2 : Motion

Concept 1 : starting and stopping

Lesson 1 : can you explain?

° to move or stop any object you need **force**, which it could be **push** or **pull**

Truck *versus* jet airplane

The shockwave truck : has been fitted with tree **jet engine** because it's more powerful than the engines of normal trucks

So, it's speed about **500 kilometers an hour**, more than the normal truck **five times**

To stop it the engineers used the same idea of **rocket** design to installed **three parachutes** to help in slowing it down.



Lesson 2 : making things move

There's no object can move without the effect of **force** on it **pull** or **push**.





The air has a force and it can move things as the **leaves** of trees move when air plowing

When you fix a **fire extinguisher** in a cart, it will move **backwards** and by **increasing** the **number** of fire extinguisher the **speed** of the cart will **increase** and the **distance covered increases** .



Balanced and unbalanced forces :

Balanced force	Unbalanced force
It's the force which occurs when two equal forces act on a body so it won't move.	It's the force which occurs when two unequal forces act on a body so it will move.
	
The object won't move.	The object will move.

Object in motion

Motion : it is any change in the position of an object relative to fixed point

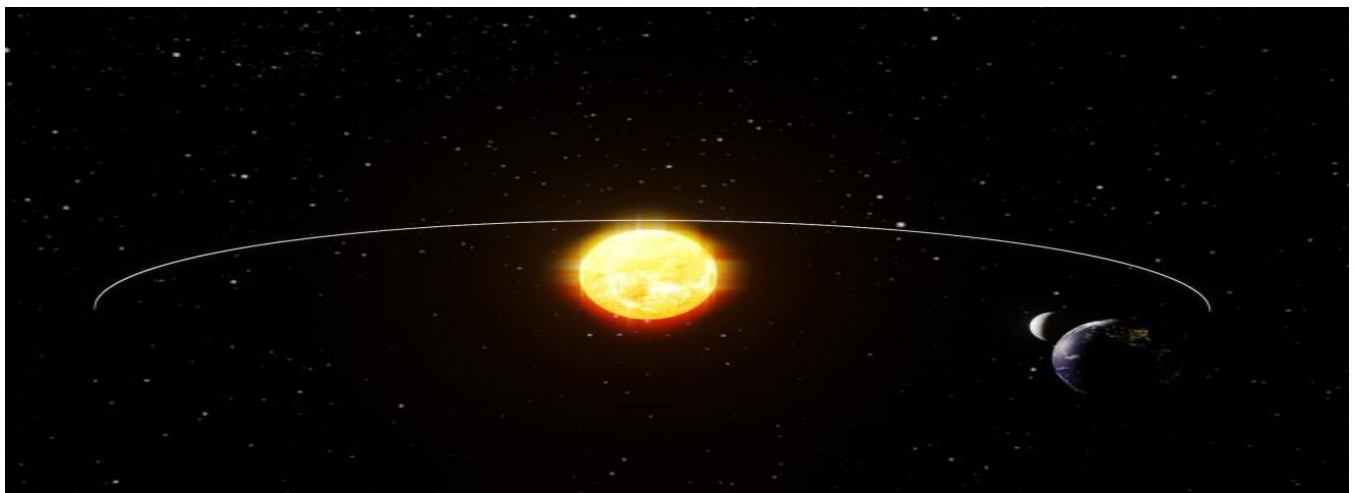
Gravity : it's the force that pull the objects towards the center of the earth

Some motion easy to see as, person walk down a street, leaf blowing in the wind, ball traveling through the air.



Some motion not easy to be seen as the rotation of the earth around the sun.

So , any object is in motion if it's **position** change even if this change cannot be seen.



Lesson 3 : force

Force : it's a pull or push that applied to an object causes it to change its position.

° when you **pull** your bag from the floor so there's many forces affecting on this bag, **pulling force of gravity**, **pulling force of your hand**.



¶° when a forces applied on a toy car **if they** :

- _ **Balanced force** So it will stop
- _ **unbalanced force** So it will start moving, or changing its speed or direction ((if it already moves))

How does an object in motion stop?

When a force with tge same amount applied in the opposite direction of its motion.

Friction : it's a force that's exerted when objects rub against each other.

¶ when a car runs out of gas so it's speed will decrease gradually due to :

_ **friction force** between **car's tires** and road.

_ **the friction force of air** and the surface of car.



Launching a satellite :

Every satellite carried by a rocket to the space.

° Before launching :

The rocket stand on its launch pads and stays still because the forces applied on it balanced

° During launch :

The forces applied be unbalanced so it move far away from the earth, once it on space it releases satellite onto orbit

° in space :

The satellite can move with the same speed for hundred years because in space there's no air so no friction force to slow down it.

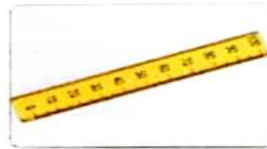


Lesson 4 : Rolling cars

► Tools



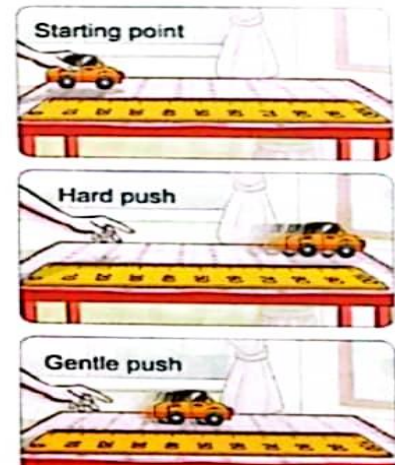
Toy car



Measuring ruler

► Steps

1. Push a toy car hard from a starting point.
2. Record the distance the toy car rolls by using the measuring tape.
3. Repeat step (1) and (2) several times, and record the data in a table, then find the average distance.
4. Push a toy car very gently from the same starting point.
5. Record the distance the toy car rolls.
6. Repeat step (4) and (5) several times, and record the data in another table, then find the average distance.



► Observations

- The car moves a **large** distance when it is pushed **hard** as shown in the following table :

Hard push	
Trial	Distance (cm)
1	90 cm
2	75 cm
3	80 cm
4	95 cm
The average distance = $\frac{90 + 75 + 80 + 95}{4} = 85 \text{ cm}$	

- The car moves a **small** distance when it is pushed **gently** as shown in the following table :

Gentle push	
Trial	Distance (cm)
1	14 cm
2	17 cm
3	20 cm
4	17 cm
The average distance = $\frac{14 + 17 + 20 + 17}{4} = 17 \text{ cm}$	

► Conclusions

- Hard push causes object to travel a long distance.
- Gentle push causes object to travel a small distance.

Lesson 5 : Energy, force, work

When you **push** a car, moving the car need a lot of **force** so

When you **push** the **energy** Transfer from your body to the car due to the force that your body exerted , and when the car move so you are doing a **work**

Force : is the effect that changes energy, that make this energy has the ability to do work.

So ,

The work done = the energy transferred by a force



Concept 2 : energy and motion

Lesson 1 : can you explain?

- ¶ All moving objects have a **kinetic energy**
- ¶ objects that don't move have a **potential energy** stored inside it

Roller coaster :

1. **At beginning** : there is an electric motor work by electricity to carry the train up to the top of the hill
2. **In the highest point** : the cars of train stored energy during their rising up.
3. **As it move down** : the stored energy changes to more active form of energy " kinetic energy" help it to move downward and it increases as the speed increase.



Forms of energy :

Mechanical energy "anything move"	Fan , clock with moving hands
Chemical energy "stored energy"	Food., batteries, cell phone
Thermal energy "any thing give heat"	Electric heater, matches
Light energy "anything give light"	Electric lamps, flashlight, computer screen
Electric energy "anything work by electric"	Computer, TV , washing machine, blender
Sound energy "anything produce sound"	Radio, musical instruments, Tv, alarm bells

Lessons 2 : what do you know?

Examples on the importance of energy :

- 1. We eat food to take energy to move**
- 2. Make objects move**
- 3. operating electric devices**
- 4. Help in cooking**

Moving energy :

The energy transfer from an object to another

Example on player kick a ball:

- 1. The energy transfer from the player's foot to the ball**
- 2. The ball moves in the air**
- 3. The energy transfer from the ball to the goal net so it will vibrate**



Energy basics :

Energy : it is the ability to do work or cause changes

Work : it's a force that cause an object to move a distance

Facts about energy :

1. Energy can be stored and change from one form to another
2. Most forms of energy cannot be seen like : sound, heat, electricity
3. We can see and measure what energy can do.

Potential energy : it's the amount of energy that stored in an object due to its position

Kinetic energy : it's the energy in an object due to its motion

****when an object have a potential energy so it's ready to do work**

Example on changing energy :

1 Acrobat ① on the tower has a potential energy.



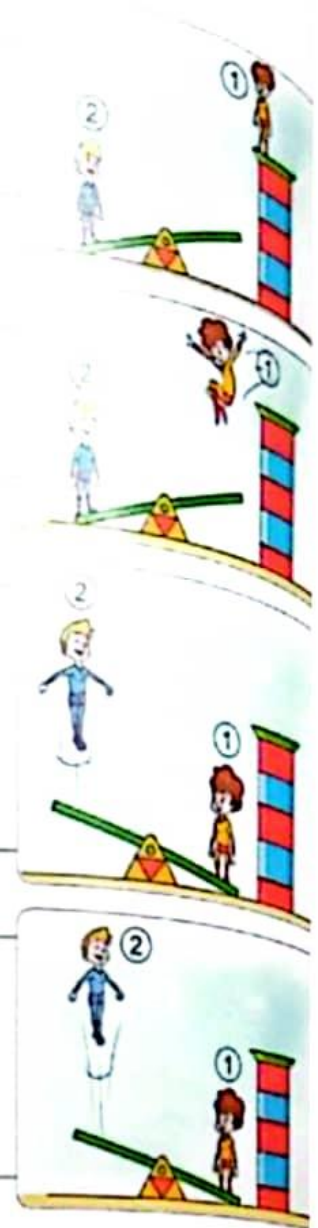
2 When he jumped down, his potential energy is converted into kinetic energy.



3 The resulted kinetic energy transfers to the acrobat ② who standing on the seesaw at the base of the tower and causes him to be pushed up into the air.



4 During the movement of acrobat ② up in the air, its kinetic energy is converted gradually into potential energy.



Lesson 3 : Forms of kinetic and potential energy

Potential energy	Kinetic energy
Gravitational potential energy	Sound energy
Chemical energy	Thermal energy
Elastic potential energy	Light energy
	Electric energy





° Example of changing the potential into kinetic energy

When a child at the top of a slide, so it has potential energy. When he moves down the **potential energy** changes to **kinetic energy**.

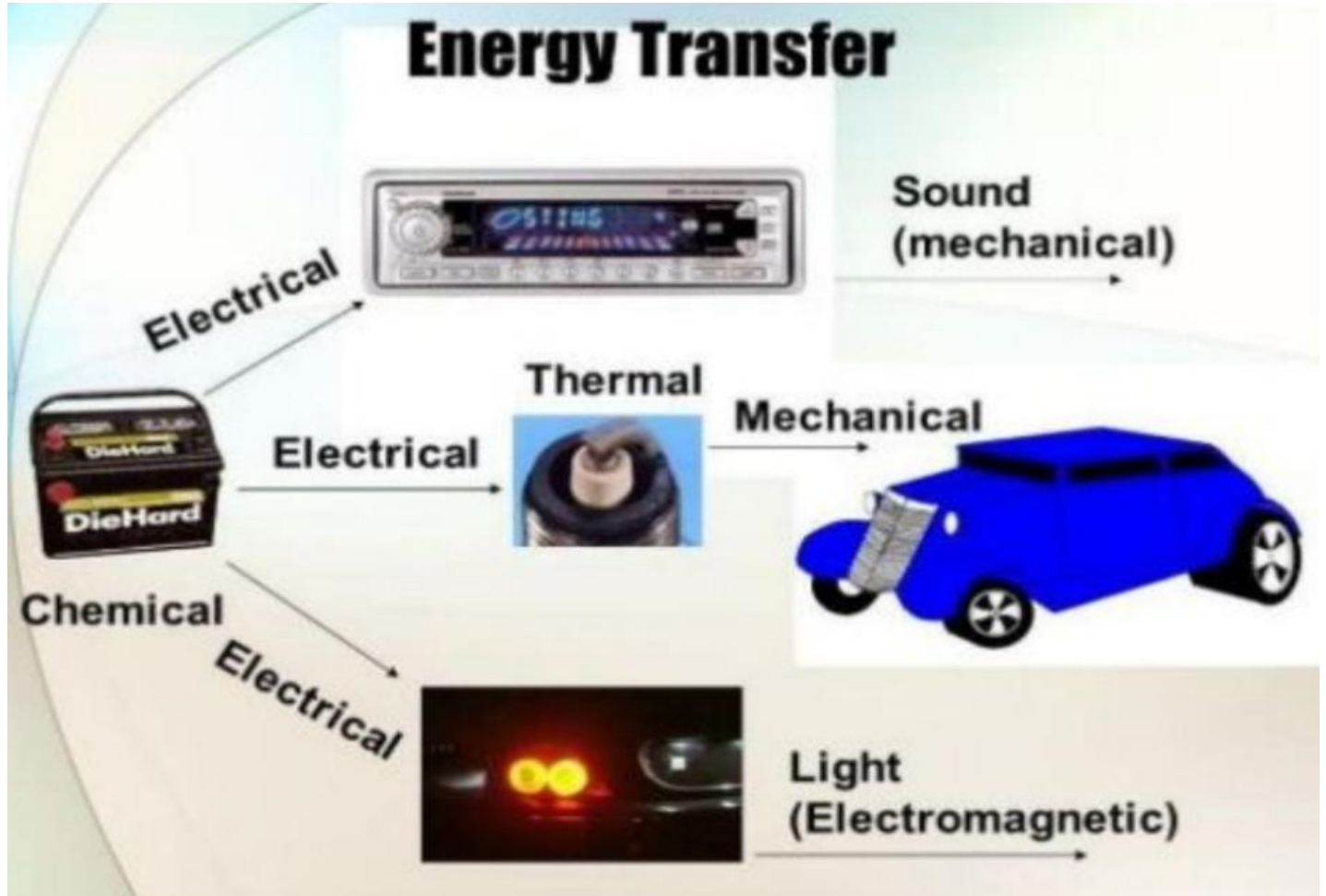
° the potential energy depends on the **mass** of object and its **height** from the earth surface.



Changing of potential into kinetic :

Example	Source of energy	From	To
Flash light 	Battery	Chemical	Light and Thermal energy
Gas oven 	Natural gas	Chemical	Thermal
Spring powered car 	Spring wire	Potential	Kinetic
Real car 	Gasoline	Chemical	Mechanical kinetic and sound and Thermal energy

Lesson 4 : energy transformation in engines



The engine of the car work by **gasoline** which is **petroleum** so its chemical energy. The internal **combustion engine** help in safely burning of gasoline into **kinetic energy** help car to move.

So, energy cannot be created or destroyed but it changes from one form to another.

The changes in forms of energy inside robot :

- 1. The chemical energy stored in the battery of robot changes to**
- 2. Electrical energy in the robot hand changes to**
- 3. Mechanical kinetic energy when the robot hand move.**

Transformation of potential and kinetic energy in ice skating :

- 1. When the skater begins the potential energy changes to kinetic energy**
- 2. The kinetic energy help him to jump high in the air**
- 3. At the top of the jump, he has the most potential energy.**
- 4. The gravity pulls him back to the ice so the potential energy changes to kinetic energy again.**



Concept 3 : speed

Lesson 1 : can you explain?

Distance : it's the distance that the object traveled

Measure in **kilometers** or **meter**

Time : it's the time taken by the object to travel a distance, Measure in **second** or **hours**

So, speed = distance ÷ time

Measure in **kilometers per hours** OR **meter per second**

Cheetah speed :

The cheetah is the **fastest** land animal, it faster than human, its run **100 meter in 6.4 seconds** and it can change it's speed from **zero** to **95.5 kilometers per hour** in three seconds. When the train can reach this speed in **7** seconds and the fastest car can reach it in **4** seconds



The physical characteristics of cheetah :

1. Its head low to the shoulder to resist the air
2. Large nose opening which help in breath a lot of air
3. A larger oversize powerful heart.
4. It's spine flexible, act as spring for its leg muscles
5. Cheetah sticks It's claws in the ground while running to push of the ground.
6. It has light wight where it is average weight for the male from 41 to 45 kg.



Lesson 2 : basics of speed

Speed : it's the distance traveled in a certain amount of time.

Measuring units :

- 1. Kilometers per hour (km/hr)**
- 2. Meter per seconds (M/ S)**

To compare the speed between tow objects

- 1. Measure the distance that both of objects traveled in the same time abd the object that move greater distance has more speed.**
- 2. Measure the time taken by both of them to cover the same distance and the smaller amount of time is faster.**

Lesson 3 : measuring speed

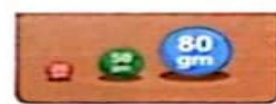
► Tools



30 cm ramp



Books



3 balls with different masses



Stopwatch



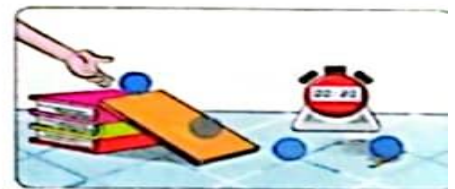
Measuring tape



Masking tape

► Steps

1. Set up the ramp, as shown in the figure.
2. Measure 1 meter from the end of the ramp and place a piece of masking tape on the floor as a finish line.
3. Roll the three different balls gently down the ramp without pushing them, one at a time.
4. Start the stopwatch as you release each ball, then stop the stopwatch when the ball passes the finish line.
5. Record the results in the following table :



Balls	Time (seconds)
Blue ball	20 sec.
Green ball	25 sec.
Red ball	30 sec.

► Observations

- The blue ball which has the **biggest** mass reaches the finish line in 20 seconds so it has the **fastest** speed.
- The red ball which has the **smallest** mass travels the same distance in 30 seconds so it has the **slowest** speed.
- The green ball which has the medium mass travels the same distance in 25 seconds so it has the medium speed.

► Conclusion

The **speed** of each ball depends on the **mass** of this ball.

part (2) : The relation between the kinetic energy and the angle of incline.

5. Now, repeat each incline, but place the paper cup at the bottom of the tube as shown in the figure.

6. Measure the distance the cup moves after each time the truck rolls into it, and record in the table the distance that the cup travels in the column "Distance the cup traveled".



(Note : As the "Distance the cup traveled" increases, the kinetic energy of the toy truck increases).

Number of books	Part (1)	Part (2)
	Time to travel	Distance the cup traveled
2 books	5 seconds	3 cm
3 books	3 seconds	4 cm
4 books	2 seconds	7 cm

► Observations

- As the angle of incline increases, the speed of the truck increases as it takes less time to reach the end of the tube.
- As the angle of incline increases, the distance that the paper cup traveled increases.

► Conclusions

- As the speed of a moving object increases, its kinetic energy increases.
- Both speed and kinetic energy increase, as the angle of incline increases.

Lesson 4, 5 : calculating speed.

Speed = distance ÷ time

° As the **speed** of moving object **increases** the **kinetic energy increase** and both of them **increase** by increasing the **angle of inclination**

° when more **forces** applied on an object, it's **speed increases** so, it's **kinetic energy increases**.

When driver want to increase the speed of a car :

Press the gasoline pedal to send **more amount** of **gasoline** to the engine so it burns it and change this **chemical energy** to **kinetic energy** which provides more force to increase the **speed** of car.

When driver wants to decrease the speed of the car :

Take his **foot off** the gasoline pedal to **decrease** the amount of **gasoline** send to the engine so the amount of **kinetic energy decrease** so its **speed** decrease.

